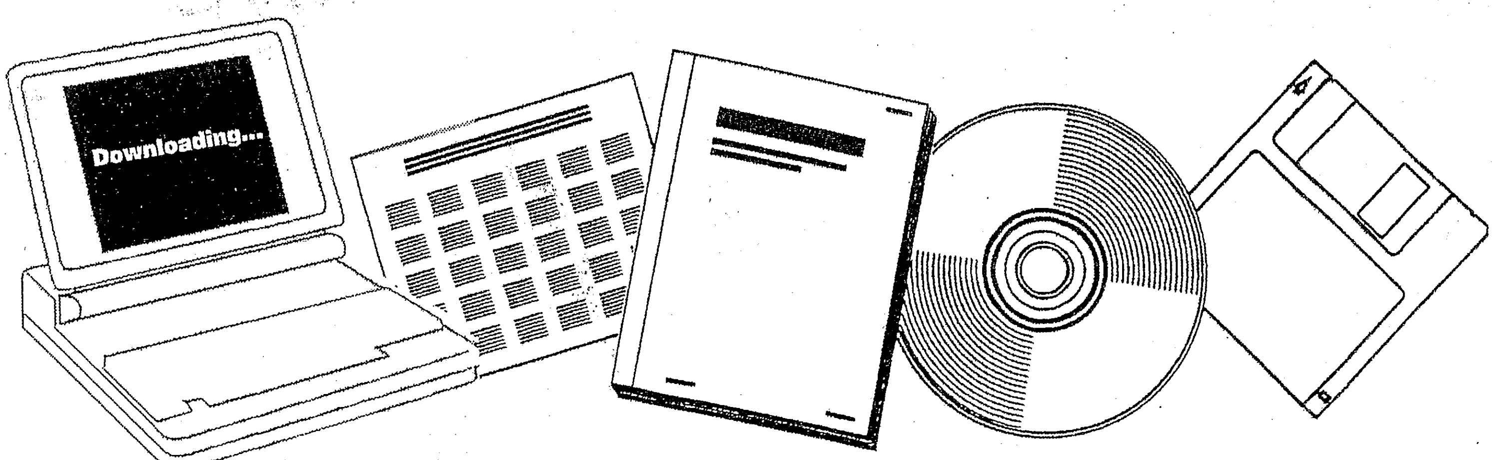
THE GAZ-66 TRUCK, ITS DESIGN AND TECHNICAL SERVICING

ARMY FOREIGN SCIENCE AND TECHNOLOGY
CENTER CHARLOTTESVILLE VA

22 JAN 1973



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ARMY MATERIEL COMMAND

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FOREIGN SCIENCE AND TECHNOLOGY CENTER

THE GAZ-66 TRUCK, ITS DESIGN AND TECHNICAL SERVICING

by

B.V. Yershov, M.V. Zaletayev, R.G. Zavorotnyy and
B.A. Solntsev

USSR

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NOTICE

The contents of this publication have been translated as presented in the original text. No attempt has been made to verify the accuracy of any statement contained herein. This translation is published with a minimum of copy editing and graphics preparation in order to expedite the dissemination of information.

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13. ABSTRACT

This manual presents detailed cut-away drawings of the design features of the GAZ-66 and its modifications. Recommendations for technical servicing, replacement of basic parts in the course of operation, principles of operation of the complex mechanisms of the truck as well as recommendations for the usages of fuel, lubricants and working fluids are also given.

The GAZ-66 manual was established as a reference for individual investigation of automotive technology by engineering-technical workers and driver personnel, as well as for student performing laboratory work at institutes of higher learning and technical schools, automotive technology service schools and for drivers of classes 1, 2, and 3.

DD FORM 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

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Introduction

Our economy needs trucks which can operate equally well on hard paved roads, country roads and cross country in the various climatic zones of our country, from the deserts of Central Asia to the snow-covered plains of the polar region.

The GAZ-63 truck, earlier manufactured for these purposes by the Gor'kiy Motor Vehicle Plant is being replaced by the new, improved GAZ-66 truck, designed for transportation of cargo and people, and also for pulling of trailers over roads of all classes and cross country. The GAZ-66 truck can be widely used in the agricultural regions of our country, particularly during the spring and fall seasons of poor roads and during severe winter weather, when ordinary trucks (with one driving axle) are practically unuseable.

This truck can easily cross the desert with a full load in its body -- 2 tons -- and a trailer with a gross weight of up to 2 tons. It can climb loose, sandy slopes of up to 24°, can cross snow drifts up to 0.7 m deep and can ford streams up to 0.8 m deep (with hard bottoms).

The high reliability and good performance of the GAZ-66 have been demonstrated over the long and difficult run from Gor'kiy to Vladivostok, under widely varied road conditions.

As a result of the successful efforts of the manufacturing plant to increase the strength and durability of parts and units, the GAZ-66 can deliver up to 120,000 km before overhaul. This service life before overhaul is guaranteed only if the fuel and lubrication materials recommended by the plant are used and if the preventative maintenance schedule is regularly followed.

Mass production of the new GAZ-66 and their use in various areas of the national economy required detailed study of this complex model in driver and mechanic training courses in higher and specialized secondary educational institutions. Visual aids, including cards and albums of color pictures of the basic mechanisms of the vehicle and their operating principles are important for the training process.

This album contains 45 multicolor tables with cross sections, diagrams and overall views of the aggregates and instruments of the GAZ-66 truck. A description of the design of each unit and its operation are attached to each table, recommendations for maintenance, replacement of the most important parts, adjustment and expendable materials to be used as of January, 1969 are presented with each table.

The album has been produced by a team of author's consisting of university instructors, B. V. Yershov and M. V. Zaletayev from Moscow and Gor'kiy Motor Vehicle Plant designers, engineers, R. G. Zavorotniy and B. A. Solntsev. The cross sections and original operating diagrams of aggregates and mechanisms of the truck were made by a team of artists under the leadership of B. V. Yershov and M. V. Zaletayev.

The scientific editor was the chief designer of the Gor'kiy Motor Vehicle Plant, A. D. Prosvirnin and V. A. Vorob'yev-Obukhov, a leading engineer.

Preparation of the album for the press, editing of the text and of the many tables were performed at the card, album and list editing shop of "Kolos" Press.

All comments should be sent to the editors at: Moscow, B-66, GSP, Sadovo-Spasskaya, No 18, "Kolos" Press, Cards, Albums and List Section.

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Modifications of the GAZ-66 Truck

The GAZ-66 truck is manufactured in the following six main modifications:

GAZ-66 -- the base model (without winch and tire pressure regulation system, with non-shielded electrical equipment).
GAZ-66-01 -- without winch, with tire pressure regulation system and unshielded electrical equipment.
GAZ-66-02 -- with winch and tire pressure regulation system, with unshielded electrical equipment.
GAZ-66-03 -- without winch or tire pressure regulation system, with shielded electrical equipment.
GAZ-66-04 -- without winch, with tire pressure regulation system and shielded electrical equipment.
GAZ-66-05 -- with winch, tire pressure regulation system and shielded electrical equipment.

In 1969, the GAZ-66 base model and GAZ-66-03 were note manufactured.

The GAZ-66 has a progressive "cabin over engine" arrangement. This arrangement has allowed an increase in the useful area of the bed, a decrease in the loading height and almost even distribution of weight over the axles.

Maintenance of all models of the GAZ-66 is performed at intervals called for by the Gor'kiy Motor Vehicle Plant and the regulations for maintenance and repair of motor transport rolling stock.

The regulations call for the following types of maintenance:

-- daily servicing (EO);
-- first technical maintenance (TO-1);
-- second technical maintenance (TO-2).

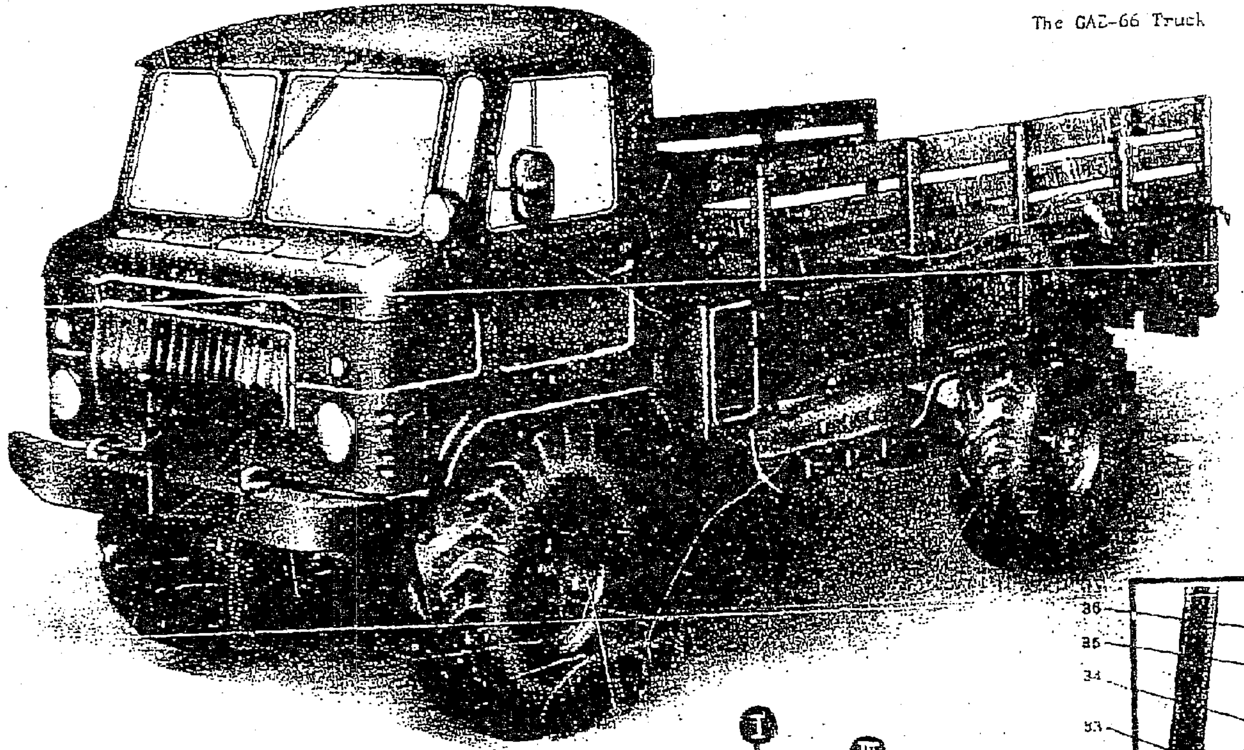
The frequency of maintenance of the GAZ-66 recommended by the plant is illustrated in the Table.

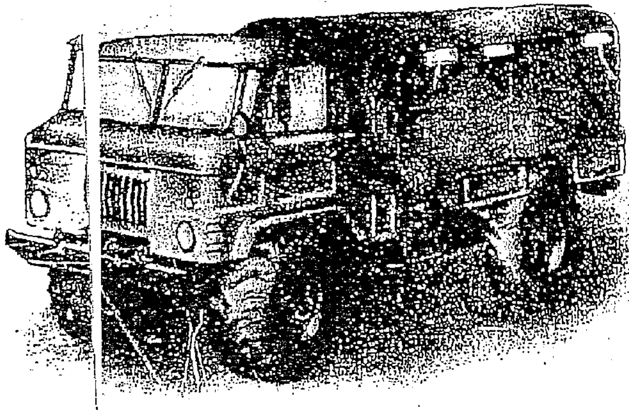
Note. When the vehicle is operated under severe conditions (in desert sandy terrain, high mountain regions, in the far North, off roads and cross country), the mileage between maintenance operations presented in the Table should be decreased by 25-30%.

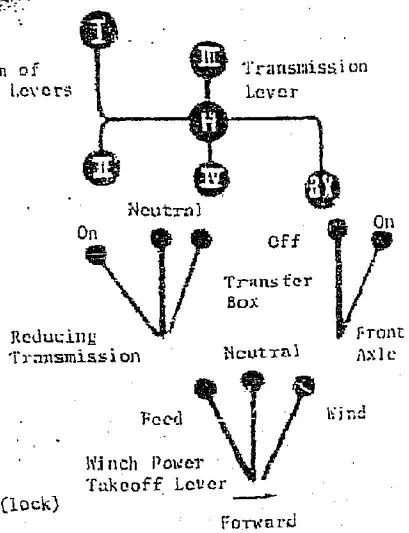
Furthermore, the plant recommends that an additional group of seasonal maintenance operations be performed on the vehicle twice per year, in preparation for summer and for winter, and that a special combination of maintenance operations be performed during breaking in of a new truck. The break-in period is 1,000 km, although actually breaking in of parts continues for at least the first 6,000 km.

Operating Conditions of the Vehicle	Mileage Interval Between Maintenance Cycles, km	
	TO-1	TO-2
City and suburban roads with asphalt, concrete and other improved hard pavement, in good condition.	1,700	8,500
Suburban rubble, gravel stone and other rock roads in satisfactory condition. Heavy city traffic.	1,400	7,000
Dirt, rock or defective roads with rubble, gravel, pebble or other hard cover. Operation with heavy maneuvering (road construction, in quarries, mines, forrests.	1,100	5,500

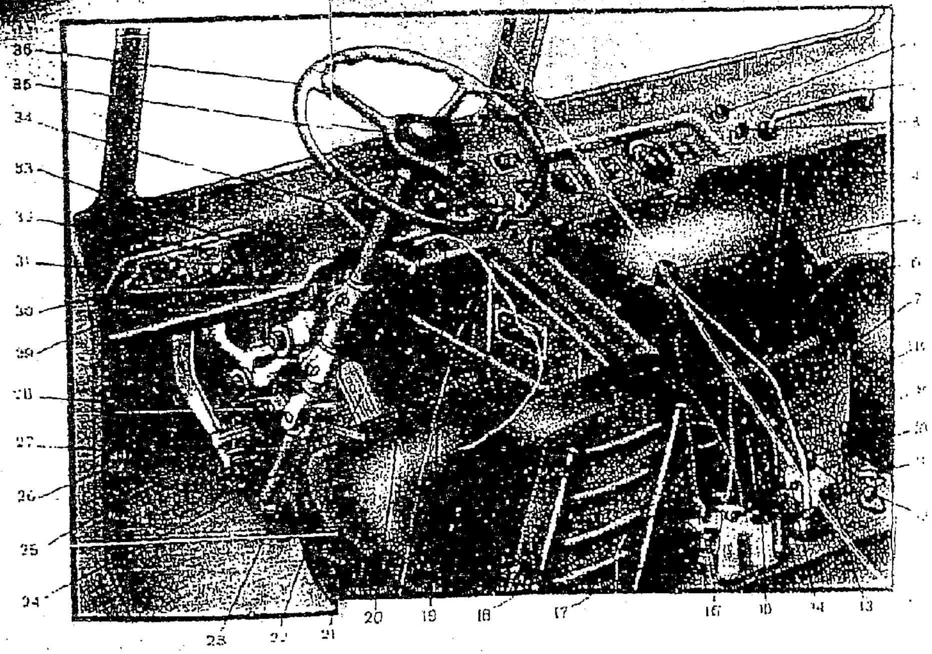
The GAZ-66 Truck







Controls of the Truck



1 - windshield defrost lever
2 - passenger hand grip lever
3 - cabin heater air valve lever
4 - tire pressure indicator
5 - transmission shift lever
6 - engine compartment
7 - front axle engagement lever
8 - transfer box shift lever
9 - winch drive takeoff shift lever
10 - electric starter preheater magnetic valve and motor switch
11 - fuel tank switch
12 - "ground" switch
13 - preheater circuit breaker button
14 - starting preheater ignition switch
15 - air valve lever
16 - radiator cover lever
17 - choke
18 - hand brake
19 - heater fan switch
20 - cabin ceiling switch
21 - adjustable driver seat
22 - gas pedal
23 - brake pedal
24 - steering column
25 - clutch pedal
26 - windshield washer pedal
27 - dimmer switch
28 - jack
29 - fuel gauge switch
30 - turn signal lever
31 - central light switch
32 - spotlight switch
33 - ignition and starter switch (lock)
34 - dashboard
35 - horn button
36 - steering wheel

3

3-a

Design Features of the GAZ-66 Truck

Basic Data

Load capacity, t	2.0
Maximum weight of loaded trailer, t	2.0
Weight of vehicle, equipped (without additional equipment), kg	
without winch	3,440
with winch	3,640
Distribution of weight between axles, kg	
without winch	
on front axle	2,120
on rear axle	1,320
with winch	
on front axle	2,340
on rear axle	1,300
Weight of truck with full load, kg:	
without winch	5,770
with winch	5,970
Distribution of weight of truck with full load on axles, kg:	
without winch on front axle	2,710
without winch on rear axle	3,060
with winch on front axle	2,930
with winch on rear axle	3,040
Dimensions, mm:	
length	5,655
width	2,340
height at cabin (unloaded)	2,440
height at canvas cover (unloaded)	2,520
Wheel base, mm	3,300
Front track, mm	1,800
Rear track, mm	1,750
Road clearance of truck (fully loaded), mm	315
Turning radius at outer front wheel, m	9.5
Maximum grade on dry ground, degrees	30
Top speed (loaded) without trailer on horizontal, smooth highway, km/hr	95

Adjustment Data

Valve clearance on cold engine (15-20°), mm	0.25-0.30
Sparkplug gap, mm	0.8-0.9
Breaker point gap, mm	0.3-0.4
Free travel of clutch pedal, mm	30-37
Free travel of brake pedal, mm	8-13
Fan belt movement under load of 4 kg, mm	10-15
Compressor and power steering pump belt movement under 4 kg load, mm	15-20
Tire pressure, kg/cm^2	2.8

Capacities

Fuel tanks, l	210
Engine cooling system, l	23
Engine lubricating system (including centrifugal filter), l	8.0
Air filter, l	0.55
Transmission, l	3.0
Transmission with winch power takeoff, l	4.2
Transfer box, l	1.5
Rear axle, l	7.6
Rear axle for trucks with automatic tire pressure regulating system, l	6.4
Front axle, l	7.7
Steering mechanism, l	0.5
Shock absorbers (4 ea), l	1.65
Winch reducing transmission, l	0.8
Power steering, l	1.8
Front axle rotating cams, g	1,000
Hydraulic brake system, l	0.75
Starting heater fuel tank, l	2.0
Windshield washer tank, l	1.5

The GAZ-66 is a two axle truck with high cross country ability, with four driven wheels. Its wheel formula is 4 x 4.

The load capacity of the truck is 2 tons, and it is designed to operate with a trailer with a total weight of 2 tons. The basic data on the GAZ-66 truck are presented in the Table.

The truck carries V-8 engine 17, developing 115 hp (at 3,200 rpm) and 29 kgm torque (at 2,000-2,500 rpm).

The comparatively low weight of the truck is evenly distributed between axles 5 and 44 (see basic data). The considerable specific power (19.9 hp/t) and good suspension allow the truck to move rapidly over various types of roads.

The truck has a top speed of 95 km/hr, and covers the standing start kilometer in 62 sec, as against 72 sec for the GAZ-63. The average speed of the truck on bumpy dirt roads has been increased from 19 km/hr for the GAZ-63 to 35 km/hr for the GAZ-66. In order to provide high cross-country ability, the torque from engine 17 is delivered to the front axle 5 and rear axle 44 (through transmission 32, transfer box 38, front and rear differentials), and to the front driving wheels 2 and rear driving wheels 53. The even distribution of weight between the driving axles allows effective utilization of the weight for traction, while the use of limited-slip differential allows up to 80% of the torque to be delivered to the nonslipping wheels. High cross country ability is also assured by the use of a centralized tire pressure adjusting system (controlled from the cabin) on the GAZ-66-01, GAZ-66-02, GAZ-66-04 and GAZ-66-05, and the installation of low pressure 1,200-18 tires 1 with high-traction treads on all models.

Wheels 2 and 53 of the truck carry tubeless tires, allowing the tire pressure to be reduced to 0.5 kg/cm^2; in this condition, the truck transmits the minimum specific pressure to the ground, and can be driven on mud, sand and snow.

Due to the low load height (1,110 mm), low center of gravity and wide track, the GAZ-66 has high lateral stability. Tests have established that whereas the GAZ-63 begins to tip over when driven with a low-profile load on a concrete area around a curve with a radius of 25 m at 44 km/hr, under the same conditions the GAZ-66 retains its stability up to 65 km/hr; at this speed, the truck begins to slide rather than tip.

The truck is suspended on very "soft" springs with effective telescopic shock absorbers on both front and rear wheels, producing a very smooth ride and the ability to travel over uneven roads at high speeds.

In order to facilitate driving of the vehicle, the truck is equipped with power steering, vacuum-assisted power brakes, and synchromesh on third and fourth gears.

In order to improve the drivers working conditions, the cabin of the truck is equipped with an effective system for ventilation and heating, devices for defrosting and washing the windshield.

A hammock-type sleeping position is included in the cabin, to allow the driver to rest during long trips.

The truck has been designed for maximum ease of maintenance. The cabin tilts forward, allowing good access to the engine, clutch, transmission and other units for servicing.

The pre-start heater guarantees rapid, easy starting of the engine at low temperatures.

The number of servicing points of the GAZ-66 has not been increased over the GAZ-63 (which is being replaced by the GAZ-66), in spite of the introduction of additional units: power steering, vacuum-assisted brakes, the compressor, tire pressure regulation system, devices for tilting the cabin, etc. This has been made possible by the installation of non-lubricated polyamide bushings on the clutch and brake pedal axes, cabin tilting pins and by mounting the ends of the springs in rubber supports.

The operation and repair of the new vehicle is made considerably easier by a broad program of standardization of units and parts with other vehicles -- the GAZ-53A, GAZ-51, GAZ-63, GAZ-21 "Volga" and others.

Of the 4,131 parts of the truck, 2,537, or 64%, are standardized with these other models.

Spare tire holder. The spare wheel is installed behind the cabin in a special holder, seat 75 of which consists of two halves: the nonmoving and tilting portions.

The spare wheel is held between the two halves of the seat by two arms.

The holder has a device for mechanical lifting and lowering of the wheel. It consists of shaft 77, line 71 and ratchet 72 with dog 73. The ratchet is seated on the shaft and held down by spring 76 and a nut.

In order to lift the wheel from the ground, it must be rolled onto the tilting (moving) half of the seat, then the shaft must be rotated by the hex nut.

To make operation easier, the shaft is rotated with two wrenches connected by means of a special connector provided in the drivers tool kit. The shaft turns together with a ratchet equipped with a dog to prevent reverse rotation as the wheel is being raise.

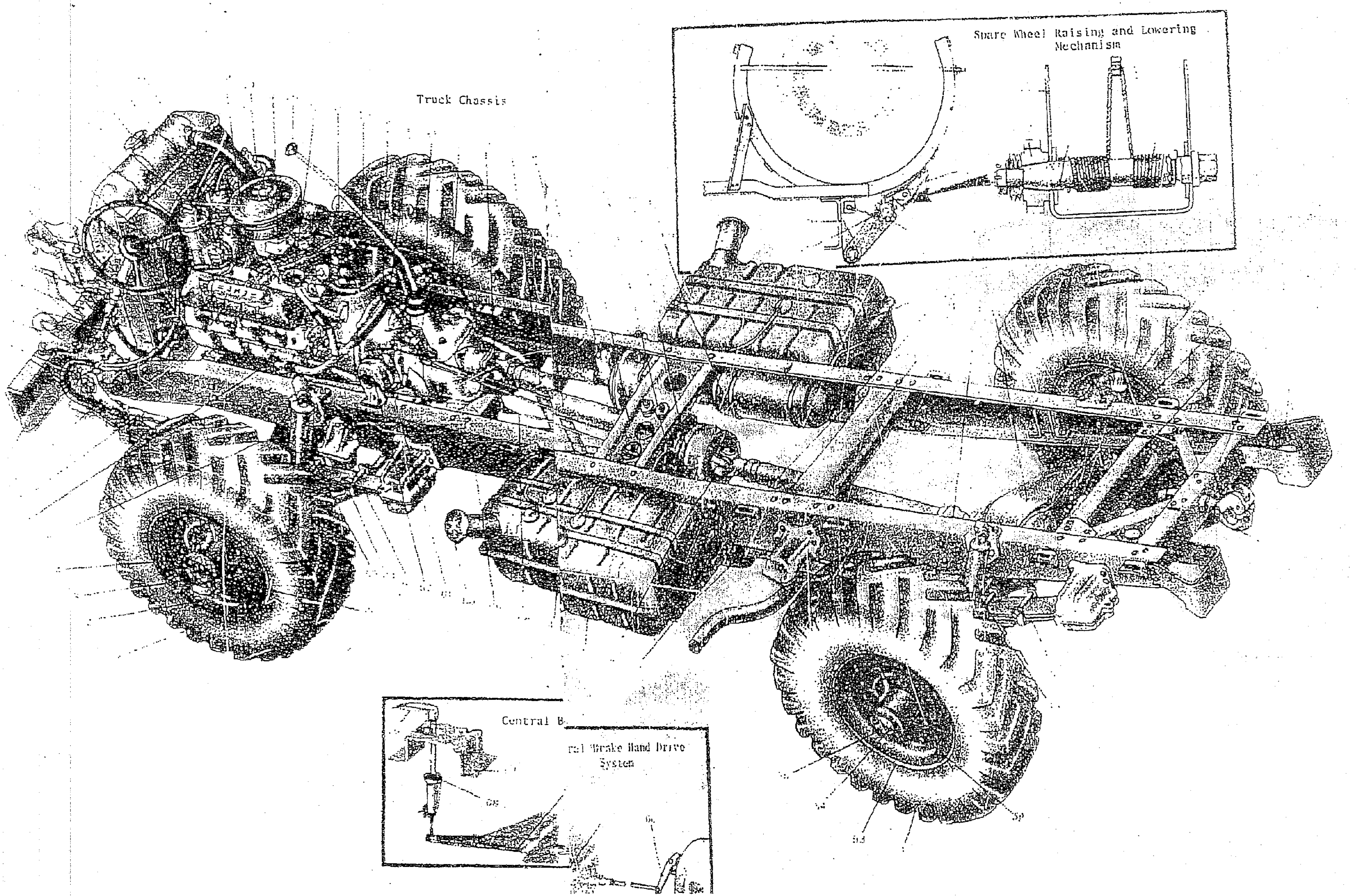
As it is rotated, the shaft winds up both ends of a rope, which passes through a hole in a bracket mounted to the nonmoving half of the seat. As it winds around the shaft, the line raises the moving half of the seat, carrying the wheel.

To lower the wheel, the shaft must be rotated in the opposite direction. The ratchet which rests against the dog is rotated with the shaft, and the line unwinds from the shaft, allowing the wheel to come down.

The tension of the ratchet against the cone can be adjusted by rotating the nut which retains the plate springs. The adjustment should be such that the wheel, at 100 mm height above the ground, will descend with an additional 10 to 15 kg of force.

1 - low pressure tire
2 - front driven steering wheel
3 - driving flange of rotating cam of front driving wheel
4 - step
5 - front driving axles
6 - starting heater tank
7 - longitudinal steering member with power steering control valve
8 - steering mechanism with steering rod
9 - front bumper
10 - hoses from oil pump to power steering unit
11 - front towing hook
12 - steering column intermediate shaft
13 - clutch pedal
14 - brake pedal
15 - brake and clutch master cylinder
16 - steering wheel
17 - engine
18 - power steering hydraulic pump
19 - centrifugal oil filter
20 - radiator cap
21 - oil filler cap (also used for ventilation of crankcase)
22 - radiator
23 - air filter
24 - tire compressor
25 - carburetor
26 - shift lever
27 - filler neck for preheater fuel
28 - distributor
29 - crankcase breather pipe
30 - front axle lever
31 - transfer box lever
32 - transmission
33 - power takeoff lever
34 - constant-velocity universal joint
35 - drive shaft
36 - brake hydraulic-vaccum assist

37 - transverse frame member for transfer box
38 - transfer box
39 - central (hand) brake
40 - centralized tire pressure control system air tank
41 - fuel tank
42 - rear drive shaft
43 - fourth transverse frame member
44 - rear driving axle
45 - rear suspension shock absorber
46 - wheel brakes
47 - fifth frame cross member
48 - sixth frame cross member
49 - rear bumper
50 - towing device
51 - rear leaf spring
52 - tire pressure regulating system tube (for transmission of air to tire)
53 - rear driving wheel
54 - rear driving wheel half axle flange
55 - flange for supply of compressed air to tire
56 - exhaust pipe
57 - muffler
58 - horizontal central brake drive bar
59 - longitudinal frame member
60 - fuel tank filler pipe
61 - clutch
62 - starter heater fan
63 - additional front spring rubber bumper
64 - front leaf spring
65 - front suspension shock absorber
66 - brake drum spreader bar lever
67 - central brake drive intermediate lever
68 - vertical drive member
69 - cabin floor bracket with rod stop
70 - hand brake lever
71 - lifting mechanism line
72 - ratchet
73 - dog
74 - lifting mechanism bracket
75 - spare wheel holder seat
76 - brake mechanism plate springs
77 - spare wheel lifting mechanism drive shaft


Truck Chassis
Spare Wheel Raising and Lowering Mechanism
Central B
ral Brake Hand Drive System

Cabin of the Truck

The GAZ-66 truck is equipped with a metal, welded, two-door cabin 1, located over the engine, allowing an increase in the size of the load-carrying body while retaining a short wheel base and improving the drivers view of the road through the windshield and cabin rear window.

The cabin is ventilated by roll up windows 12 and vent panes 10 in the doors. There are also rotating ventilating wings 8 at either side of the windshield, equipped with special baffles allowing the direction of the air flow into the cabin to be adjusted.

The cabin is equipped with an effective heating system which can be used for forced ventilation in the summer, devices for washing and defrosting the windshield, two electric windshield wipers, two sun visors and two rear view mirrors 9.

Cabin door 13 consists of two stamped metal panels -- the outer and inner panels, connected by spot welding. In the lower portion of the door on the outside there are two slits for drainage of water which might leak in through cracks and around the window seals.

In order to prevent dust, moisture and cold air from getting into the cabin, the door passages and the doors themselves are equipped with soft foam rubber weather stripping.

Both doors are equipped with cam-type latches, opened from inside or outside with rotating handles. The door latches can be locked from the outside with a key. They can also be locked from the inside by pressing a button.

The inside panels of the doors have three hatches closed with covers. The two small hatches are designed for access to the door loop bolts, the large hatch -- for installation and removal of the latch and glass lifter.

Cabin tilting mechanism. The cabin of the truck can be tilted forward on two hinges, brackets 30 of which are located in the lower front portion of the cabin, for access to the motor.

The cabin tilts forward to an angle of 45°. It is held in the tilted position by a stop with a click catch 19. When necessary (for repair), the cabin can be tilted forward to an angle of about 90°. This is done by disconnected lever 17 and 20 of the stop, removing the towing hooks and headlights. Tilting is aided by two cylindrical compression springs 27 and 28.

The cabin is held in the operating position by a latch mechanism. Lever 21 of the latch mechanism is then in its lower position, latch hook 15 meshes with cam 37, and the cam drive mechanism is closed. In addition to latch hook 15, there is also a safety hook 34, which meshes directly with cross member 22 of the frame. The two hooks are connected by arm 31, used to release both hooks simultaneously. Both hooks are held in the operating (closed) position by return spring 35.

8

Cam 37 is seated on an axis and is rotated through lever 21 of the latch mechanism, arm 33, lever 36 of the cam and the carrier on the axis. Two rubber bumpers 23 are used to produce the necessary latch tension and hold the cabin in position; the bumpers are fastened to cross member 22 by bolts. These bumpers are pressed into cups 32 when the mechanism is latched, which helps to hold the cabin in place. The height of the bumpers must be at least 36 mm. Otherwise, a shim of the necessary thickness must be placed between bumper 23 and cross member 22, or the bumpers must be replaced with new ones.

The tension of the latch hook 15 is adjusted by stop 38, which can be used to the change the position of the axis of the hook on the cabin. The stop has four setting apertures 39, each of which can mate with slot 41 on the cabin. When pin 40 is inserted in these apertures from top downward, the tension of the hook is increased, from the bottom up -- decreased.

A folding support is used to hold the cabin in the open position. It consists of two levers 17 and 20 and detent 19 with a spring. Lower lever 20 is articulated to the left longitudinal frame member, while upper lever 17 is fastened by a keyed pin to the base of the cabin. Before tilting the cabin, one must make sure that lever 18 of the transmission and the transfer box lever are in the neutral position and that there are no loose articles in the cabin.

To tilt the cabin, move lever 21 on the latch mechanism to its upper position. When this is done, cam 37 rotates on its axis and releases latch hook 15. Then, pull arm 31 back. This moves hooks 34 and 15 away from cross member 22 and cam 37, after which the cabin will begin to move forward under the influence of springs 27 and 28. To avoid breaking lever 17 and 20, the cabin support should be held as the cabin tilts forward. The cabin is held in the tilted position by stop 19 of the support, which must enter the notch in lower lever 20.

To lower the cabin, hold it in the left hand, pull stop 19 of the support away from lever 20 and pull the cabin down until hooks 15 and 34 mate with cam 37 and cross member 22, then move lever 21 to its lower position.

<u>Adjustable seats</u>. The cabin contains two identical individual seats, consisting of a base welded up of tubes 43 and 48 carrying seat cushion 55 and back cushion 42.

Each seat can be moved backward and forward and the back tilt can be adjusted.

The front to back adjustment, 75 mm long, is achieved by removing nut 50 from each side of the seat base, removing the washer, lifting the seat and setting it in its new position, matching the rods of the two retaining

brackets 51 (on slides 54) to the apertures in adjustment plates 49 and the ends of the two retaining hooks 53 to the apertures in positioners 52. After checking to be sure the seat is in the proper position, the washers and nuts 50 are returned to their positions.

To change the back tilt, press lever 46 of ratchet 45. Then tilt the back into the desired position and release the lever. The tilt back can be adjusted within limits of 10°. There are three setting apertures in stop 47 for this purpose.

Drivers sleeping position. A hammock-type folding bed can be installed in the cabin to allow the driver to rest during long trips.

When the sleeping position 14 is installed, the bed is suspended on hooks on the door uprights by four rings in its corners. The bed is also attached to brackets welded to the rear wall of the cabin by means of three belts.

Maintenance.

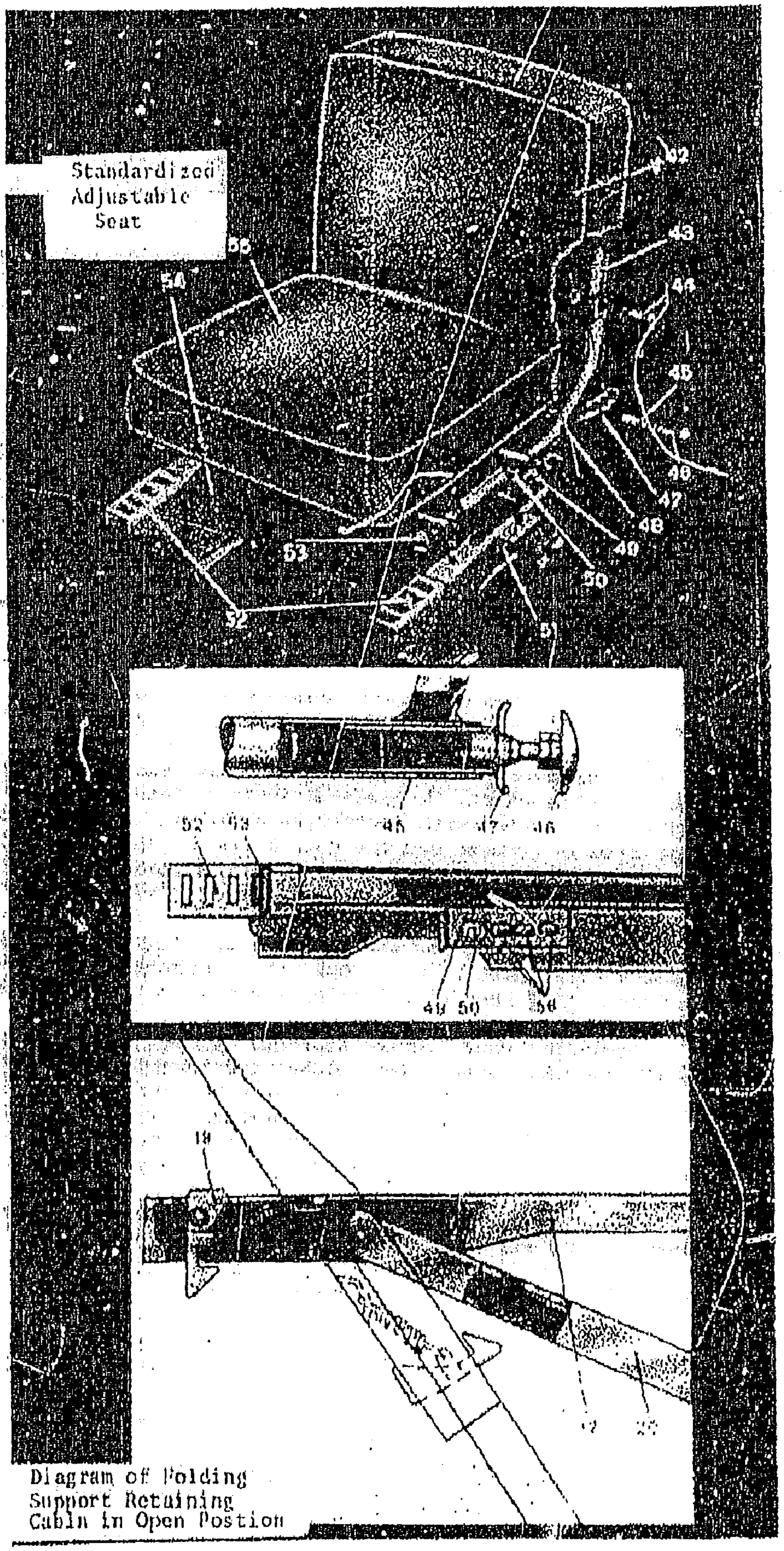
Each day, upon returning to the garage, the cabin and body are cleaned out: the windshield, windows and cabin floor are washed and dried (beneath the cover); the outside of the cabin is washed with water under low pressure (2-3 kg/cm^2), then dried with compressed air or carefully rubbed dry. Warm water (20-30°) or detergents are used to remove oil spots. After this, the condition of fasteners and paint on the cabin and doors are checked, as well as the condition of the windows, rear view mirrors and fenders. In case of damage to the paint, the damaged areas of the cabin must be immediately re-painted or covered with protective compound. During TO-1, the cabin locking mechanism is checked and the door loops are lubricated with solidol grease. During TO-2, the condition of the painted surface of the cabin and body is also checked and the fasteners of the cargo platform are tightened, and the tightness of fastening of brackets 30 of the cabin rotation axle and fastening of springs 27 and 28 of the cabin tilting mechanism is checked. To retain the shine of the paint on the cabin, it is recommended that it be periodically polished using special polishing water and a wax polishing paste.

Twice per year, during seasonal maintenance, the door latch and loops should be lubricated. The latches are lubricated with type TsIATIM-201 high-temperature lubricant, the loops -- with solidol. The cabin rotation axes in brackets 30 contain polyamide bushings, and need no lubrication. The hinges and friction surfaces of the windshield wipers must be periodically lubricated with transmission oil (5-8 drops on each point).

To avoid damage to the windshield wiper, it must not be turned on if there is a layer of dirt and mud on the glass.

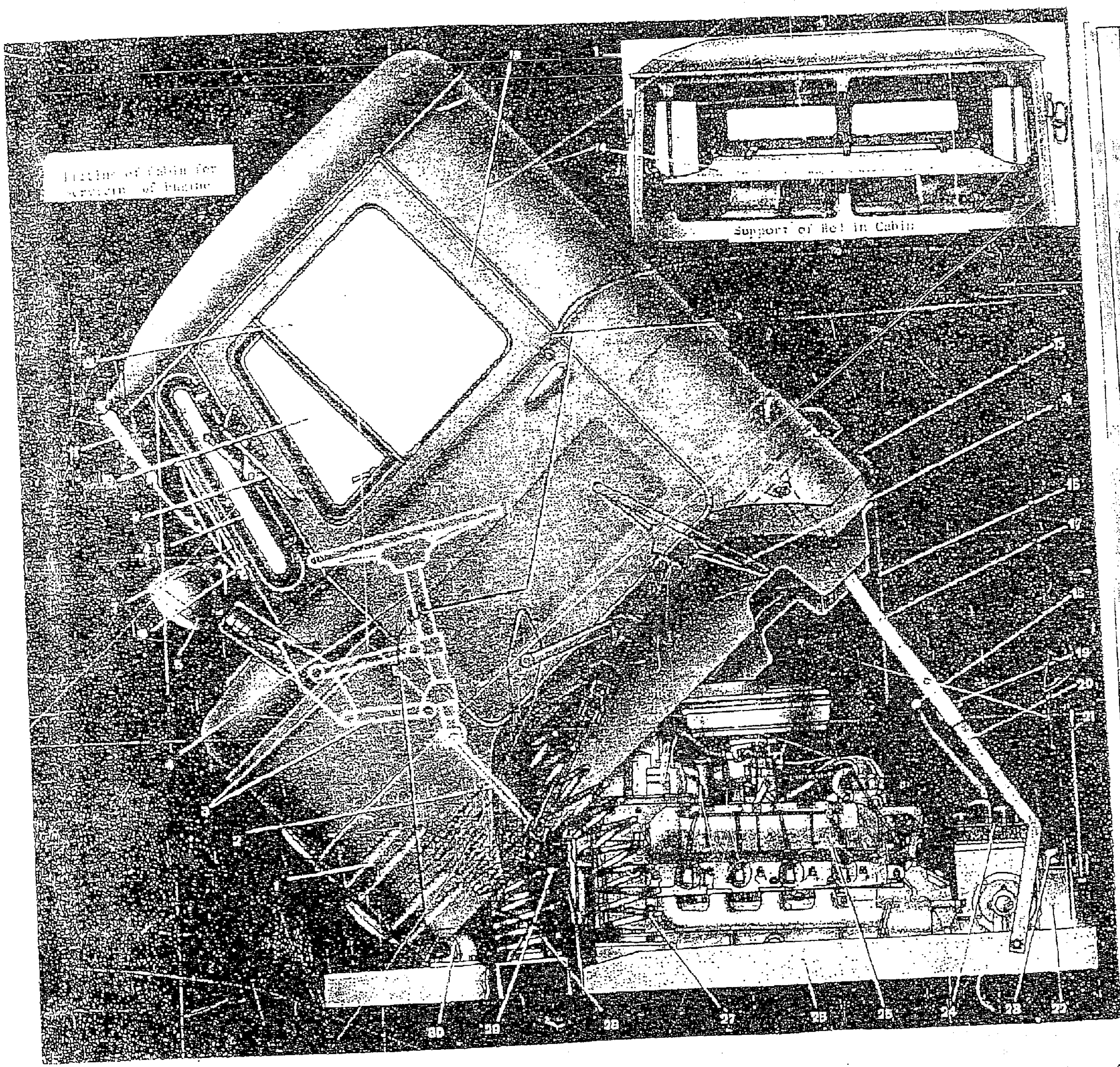
1 - cabin of truck
2 - steering column
3 - steering column bracket levers
4 - steering colum with steering wheel
5 - additional spotlight
6 - windshield side glass
7 - windshield wiper
8 - rotating ventilating window
9 - rear view mirror

10 - rotating vent wing of door
11 - windshield wiper drive lever
12 - roll up window
13 - cabin door
14 - seat
15 - cabin fastening hook
16 - sprayer
17 - upper stop lever holding cabin in open position
18 - transmission lever
19 - detent
20 - lower support lever holding cabin in open position
21 - latch mechanism lever
22 - cross member of frame for fastening cabin
23 - cabin holding cup rubber bumper
24 - control lever panel
25 - engine
26 - longitudinal truck frame member
27 - left spring of cabin tilting mechanism
28 - right spring of cabin tilting mechanism
29 - steering mechanism
30 - cabin rotating axis bracket
31 - cabin fastening hook arm
32 - cabin retaining cup
33 - latch mechanism arm
34 - safety hook
35 - hook arm return spring
36 - retaining hook cam lever
37 - retaining hook cam
38 - hook retainer for adjustment of cabin seating tightness
39 - installation apertures
40 - hook retaining finger
41 - adjusting slot in cabin
42 - seat back
43 - seat back supporting tube
44 - pin in joint between seat back frame and seat bottom frame
45 - seat tilting stop
46 - stop lever
47 - seat back adjustment retainer
48 - seat frame tube
49 - seat adjusting plate
50 - seat fastening nut
51 - installation bracket
52 - longitudinal adjustment stop
53 - seat stop hook
54 - sliding platform
55 - seat cushion
56 - apertures in adjusting plates for seat movement



Standardized Adjustable Seat

Diagram of Folding Support Retaining Cabin in Open Postion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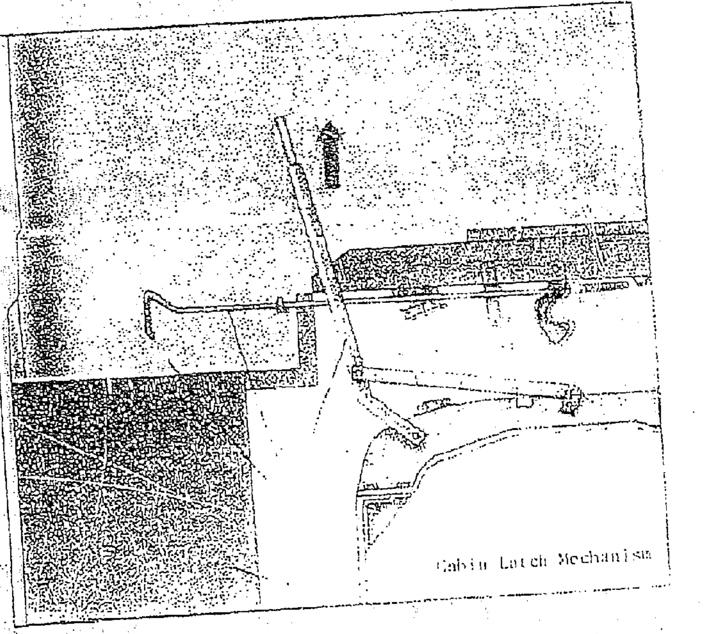
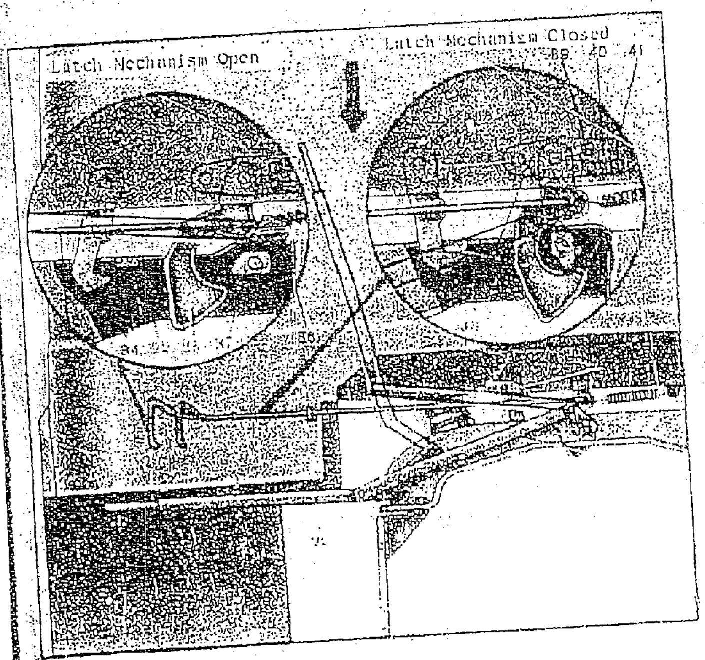
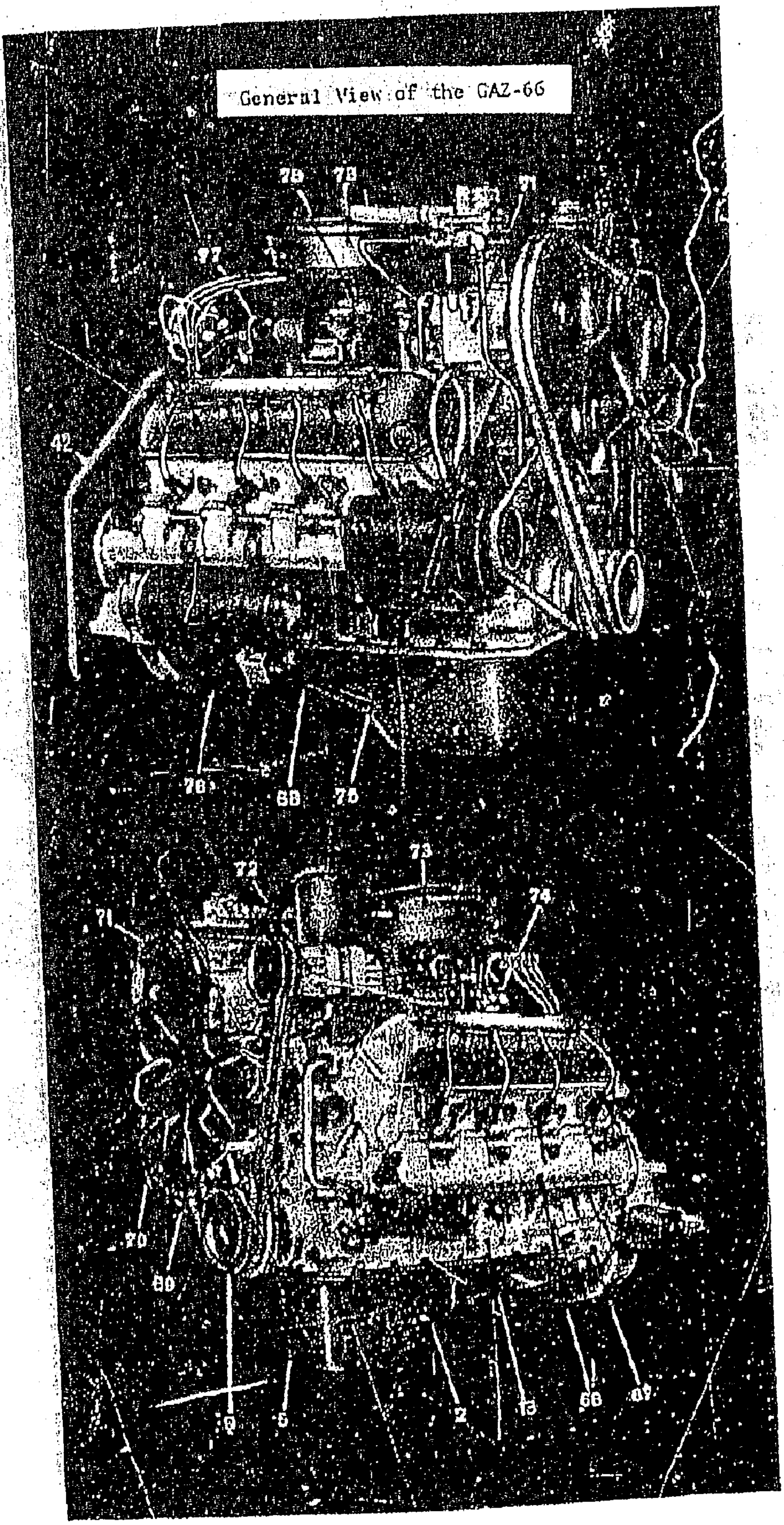

Cabin Latch Mechanism


Latch Mechanism Open
Latch Mechanism Closed

14-aa

14

General View of the GAZ-66



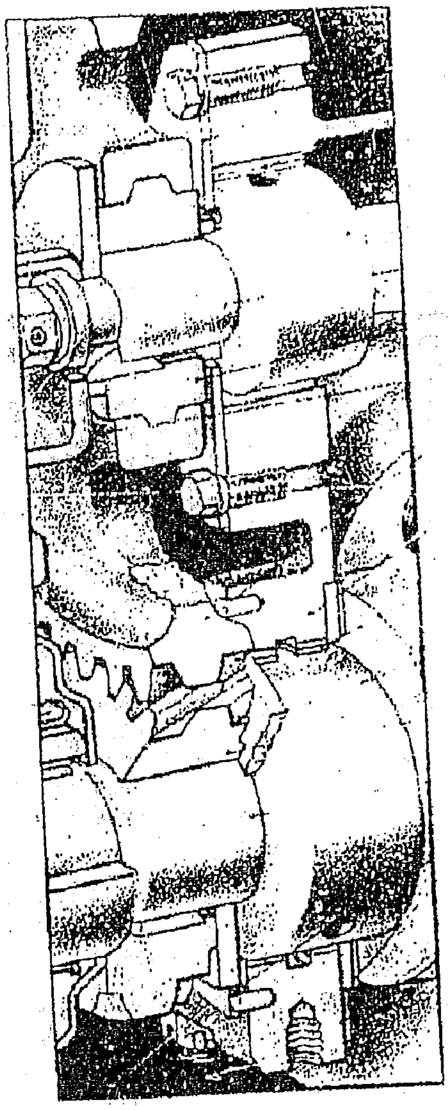
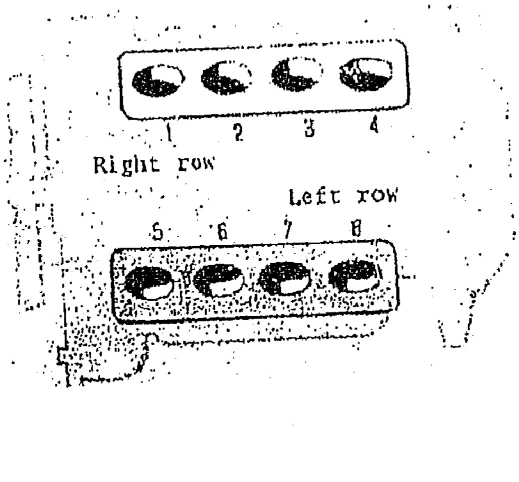
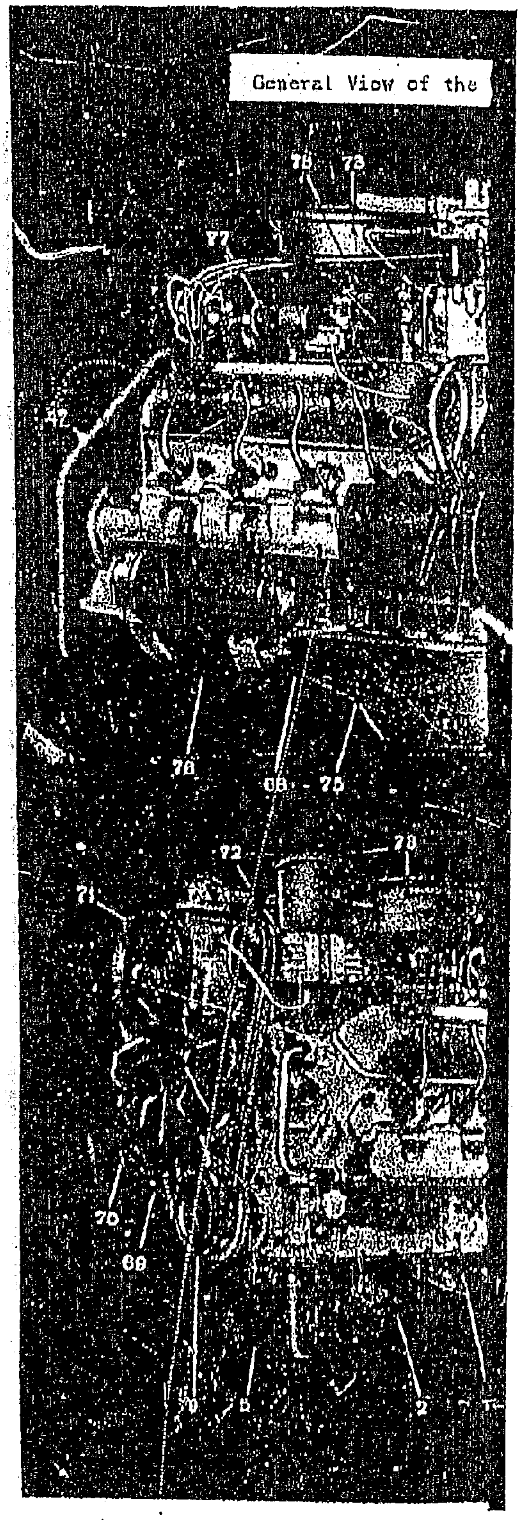
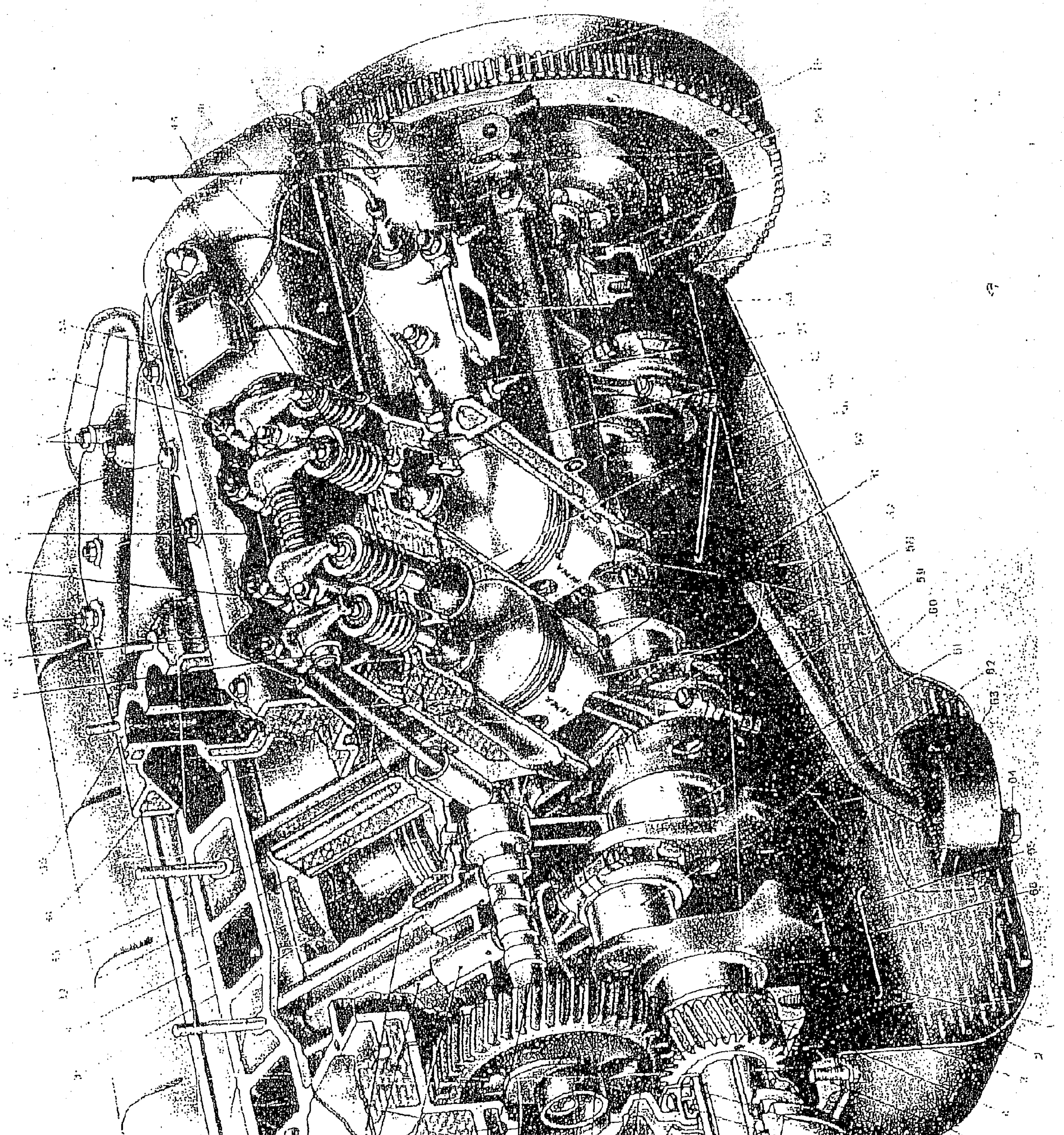


Diagram of Placement
and Numbering of Cylinders



1 - crankshaft
2 - crankcase
3 - forward main bearing cover
4 - gear (30 teeth) of crankshaft
5 - distributing gear cover
6 - oil deflectors
7 - distributing gear cover gland
8 - starting lever ratchet
9 - crankshaft pulley
10 - front bearing thrust rings
11 - steel gear thrust ring
12 - main bearing bushing
13 - block
14 - textolite gear (60 teeth) driving cam shaft
15 - cam disk (eccentric) driving fuel pump
16 - steel gear hub
17 - cam shaft
18 - journal neck
19 - spreader ring
20 - journal neck bushing
21 - thrust flange
22 - flange for installation of governor sensor
23 - flange for fastening fuel pump
24 - flange for attachment of water pump body
25 - plunger-type valve lifter
26 - valve-lifter rods
27 - head
28 - rocker arm cover
29 - channel through which fuel reaches cylinder
30 - intake manifold mounting pin
31 - piston
32 - wet cylinder liner
33 - head mounting lug
34 - intake manifold
35 - flange for installation of carburetor
36 - valve rocker arm axis
37 - valve rocker arm
38 - cooling system fluid temperature sender
39 - rocker arm axis upright
40 - rocker arm spacer spring
41 - plug closing power brake vacuum pump aperture
42 - crankcase ventilator tube
43 - valve rocker arm adjusting screw
44 - sparkplug wire retainer (cover)
45 - valve springs
46 - valve cover gasket (oil-resistant rubber)
47 - sparkplugs
48 - cylinder head retaining lug nut
49 - flywheel gear (148 teeth)
50 - flywheel
51 - rear asbestos gland
52 - rear gland holder
53 - rear main bearing cover
54 - exhaust gas channel
55 - intake valve
56 - rear oil barrier
57 - exhaust valve
58 - connecting rod
59 - connecting rod big-end cover
60 - oil collector pipe
61 - crankshaft main bearing neck
62 - crankshaft big-end neck
63 - oil pump intake
64 - crankcase oil drain plug
65 - crankshaft counter weight
66 - crankcase front cover
67 - oil pump
68 - exhaust manifold
69 - six-blade fan
70 - generator drive pulley
71 - central tire pressure regulating system compressor
72 - power steering pump
73 - air filter
74 - distributor
75 - direct current generator
76 - starter with solenoid
77 - coil
78 - carburetor





THE ENGINE

Basic Data

Engine type	four-stroke, carburetor, overhead valve, liquid cooled
Fuel for engine	motor vehicle gasoline type A-76 [GOST 2084-56]
Number of cylinders and location	8, in two rows, V-design, 90° angle between banks
Piston bore and stroke	92 × 80 mm
Swept volume	4.25 l
Compression ratio	6.7:1
Maximum power (limited by regulator) at 3,200 rpm	115 hp
Minimum idle speed, rpm	475-525
Maximum torque at 2,000-2,500 rpm	29 kg-m
Horsepower per liter	27 hp/l
Firing order of cylinders	1-5-4-2-6-3-7-8
Fuel consumption	230 g/hp·hr

The GAZ-66 engine is manufactured by the Zavolzhskiy Motor Plant. It was developed and prepared for production by the Gor'kiy Motor Vehicle Plant as a part of a family of V-8 engines for cars and trucks. A number of parts of the engine are standardized with the parts of the four-cylinder in-line engines used in the GAZ-21 "Volga" automobile, such as the piston rings, piston wrist pins, valve lifters, valve springs and plates. The GAZ-66 shares the main and big-end bearing bushings, cam shaft and drive gears, rocker arms and lifters, oil pump, distributor drive, fan and certain other parts with the GAZ-13 "Chayka" automobile.

Many of the parts in the engine subject to wear are replaceable. They can be replaced without repairing the basic parts of the engine -- the block, heads, etc.

High-strength aluminum alloys are widely used to reduce engine weight. As a result, the engine, assembled with the transmission, clutch, compressor and power steering pump, weighs only 333 kg. The GAZ-66 truck engine weighs 2.9 kg per horsepower, while the GAZ-63 engine weighs 4.5 kg per horsepower.

The two-row placement of the cylinders 32 of the engine, while retaining the swept volume of 4.25 l and short overall length of the engine (1,342 mm with transmission), has allowed the bore of each cylinder to be increased to 92 mm (as opposed to 82 mm in the GAZ-63), while simultaneously decreasing the piston stroke to 80 mm (as against 110 mm). An engine with this ratio of bore to stroke is called a short-stroke [over square -- TR.] engine. The length of the crankshaft and height of cylinder block 13 have been significantly reduced. The connecting rods of the GAZ-66 engine are significantly shorter than those of the GAZ-63 (156 mm as against 202 mm), significantly increasing

the strength of the part and reducing its weight. The total height of the GAZ-66 engine is 887 mm, its width is 845 mm.

The mean piston speed in the cylinder at the operating speed of maximum power (3,200 rpm) is 8.5 m/sec. Piston travel per km driven by the GAZ-66 is 376 m, as opposed to 575 m for the GAZ-53F, which greatly reduces piston wear.

The cylinders in the motor are numbered from the fan. Cylinders one through four fall down the right side of the motor, cylinders five through eight -- down the left side.

The left row of cylinders is shifted slightly forward in relation to the right row, since the connecting rods of opposite cylinders are installed on one neck of the crankshaft side by side (with the connecting rods of the right cylinders in front).

In order to improve volumetric efficiency, over size intake valves are used, as well as a type K-126B two-barrel downdraft carburetor and a special intake manifold, which distributes the fuel evenly among the cylinders.

For convenience of servicing and repair, those units requiring care (distributor 74, sparkplugs 47, rocker arm adjusting screws 37, carburetor 78 and air filter 73, centrifugal oil filter, compressor 71, fuel filter, fuel pump, generator 75, power steering pump 72, the starting heater, etc.) are installed on the engine in easily accessible locations.

The engine is designed to run 120,000 km before overhaul. In order to increase the engine life to first overhaul, it is desirable to replace the piston rings and main bearing bushings after 60,000-80,000 km.

By this mileage, the piston rings have generally lost their spring, and the babbitt layer of the main bearing inserts have accumulated a significant quantity of hard particles (products of wear and abrasive dust), causing scratching and rapid wear of crankshaft necks. The big-end bushings operate in cleaner oil than the main bearing bushings, since this oil is centrifugally cleaned in traps within the crankshaft necks 62. Therefore, the big-end bearings should be inspected and replaced only if necessart (these bushings generally do not require replacement until 120,000 km). At the same time, the combustion chambers in heads 27 and pistons 31 should be cleaned of scale, the centrifugal traps in crankshaft necks 62 should be cleaned of dirt, valves 55 and 57 should be turned into their seats and the cooling system should be flushed out.

The mileages shown are approximate and depend on operating conditions and the condition of the engine.

Testing Technical Condition of the Engine and Replacing Parts of the Piston Group

Determination of the technical condition of the engine without dissembly is performed by external inspection, listening and testing in various operating modes. The oil consumption, gas pressure in the crankcase, compression in the cylinders and oil pressure in the lubricating system are determined.

As the main parts of the engine wear, it begins to smoke, the oil consumption increases; the gas pressure increases in the crankcase, causing leaks ("the engine burns oil"), the compression decreases in the cylinders, and the oil pressure in the lubricating system falls below the permissible norm. With significant wear of pistons 18 and their piston rings, as well as the face of the cylinder liners 14, when the engine is cold and the rotating speed is sharply reduced, a dull, slapping piston sound is heard.

In case of great wear of the bushings of the top end of connecting rod 61, the wrist pins of pistons 18 and weakening of the seating of the wrist pin, a high, clear wrist pin knock will be heard when the rotating speed is sharply changed. It should not be confused with predetonation knock, which disappears when the spark advance is reduced. The cylinder liners may also be scratched due to weakening of the seating of the wrist pin and its axial displacement.

If the covers of main and big-end bearings on crankshaft 8 have greatly worn bushings, the main bearings produce a strong, dull, low knock and the big-end bearings produce a sharper, clearer knock. These knocks are particularly clearly heard if the load on the engine is increased.

Pistons and wrist pins should not knock when the engine is warm. If main and big-end bearing knock is heard, the engine should not be used.

When the piston rings are replaced, the cylinder liners 14 should be carefully inspected and the unworn, protruding belt should be removed from the upper portion of the cylinder liner. If the upper compression ring strikes this belt during operation, it may cause it to break.

The piston rings have a nominal diameter of 92 mm. Over size rings of 92.5, 93.0 and 93.5 mm are produced for repair purposes.

When piston rings are replaced, if the liners are not replaced or ground, the upper compression ring should be a tinned rather than chrome plated ring, since the chrome plated rings run in poorly to a worn liner.

Pistons 18 and liners 14 are selected individually, within the limits of one of five groups into which they are sorted after manufacture.

The piston diameter is measured in the lower cross section of the skirt in the plane perpendicular to the axis of the wrist pin, and the minimum internal diameter of the cylinder liner is accepted as its diameter.

The group symbol is stamped into the base of the piston, while liners are marked on the outer, ground surface. The mass (weight) of the piston of standard sizes between 533 and 537 g.

Pistons marked V, G, D, as well as liners marked with the letters A, B, V, are used not only for plant assembly, but as spare parts as well.

Liners and pistons with diameters of 92.5, 93.0 and 93.5 mm are also manufactured for repair purposes. The values of the replacement sizes are stamped into the base of the piston and onto the liners.

Correct selection of a piston and liner is checked by passing a gauge strip between the piston and cylinder on the side opposite to the notch on the piston skirt over its entire length. The piston is installed for this purpose without piston rings or wrist pin. The proper gauge thickness is 0.05 mm, width 13 mm. If the piston is properly selected, a force of 3-4 kg for new pistons and liners or 2-3 kg for used pistons and liners should be sufficient to pass the gauge through the space.

The side surfaces of pistons are marked "front" or "back." These indications must be strictly followed as the pistons are installed in the block.

Wrist pins are selected to fit the apertures in pistons and connecting rods.

Replacement wrist pin sizes have diameters of $25.08_{-0.008}$, $25.12_{-0.005}$ and $25.20_{-0.005}$ mm. They are marked black, blue and brown respectively.

When the wrist pin has conicity or ellipticity, the greatest diameter is taken as the diameter of the pin, the least diameter as the diameter of apertures in the piston and connecting rod. The marking paint is placed on the inner surface of a wrist pin or boss and the outer surface of the top end of the connecting rod.

Pistons and wrist pins must be assembled of parts from the same group (in correspondence with the color of the marking: white, green, yellow, red). A connecting rod from the neighboring group can be used. The dry wrist pin should fit smoothly into the connecting rod aperture and move smoothly through the aperture under some pressure. The difference in the weight of sets (piston, connecting rod, wrist pin) installed on the same motor should not exceed 8 g. Before pressing the wrist pin into the piston, the piston should be heated in hot water or oil to 70°. Pressing without heating may cause scratching.

The engine assembled with the clutch and transmission is fastened to the frame of the truck on four elastic mounts (two front and two rear).

The front motor mounts bear the weight of the front portion of the engine and also accept the logitudinal loadings which arise during startup, acceleration, braking and clutching.

Front brackets 13 and 59 of the motor mounts are screwed to the block by means of lugs. Front left bracket 39 is stamped of sheet steel. Front right bracket 13 is cast of foundry cast iron; it is also the generator mounting bracket.

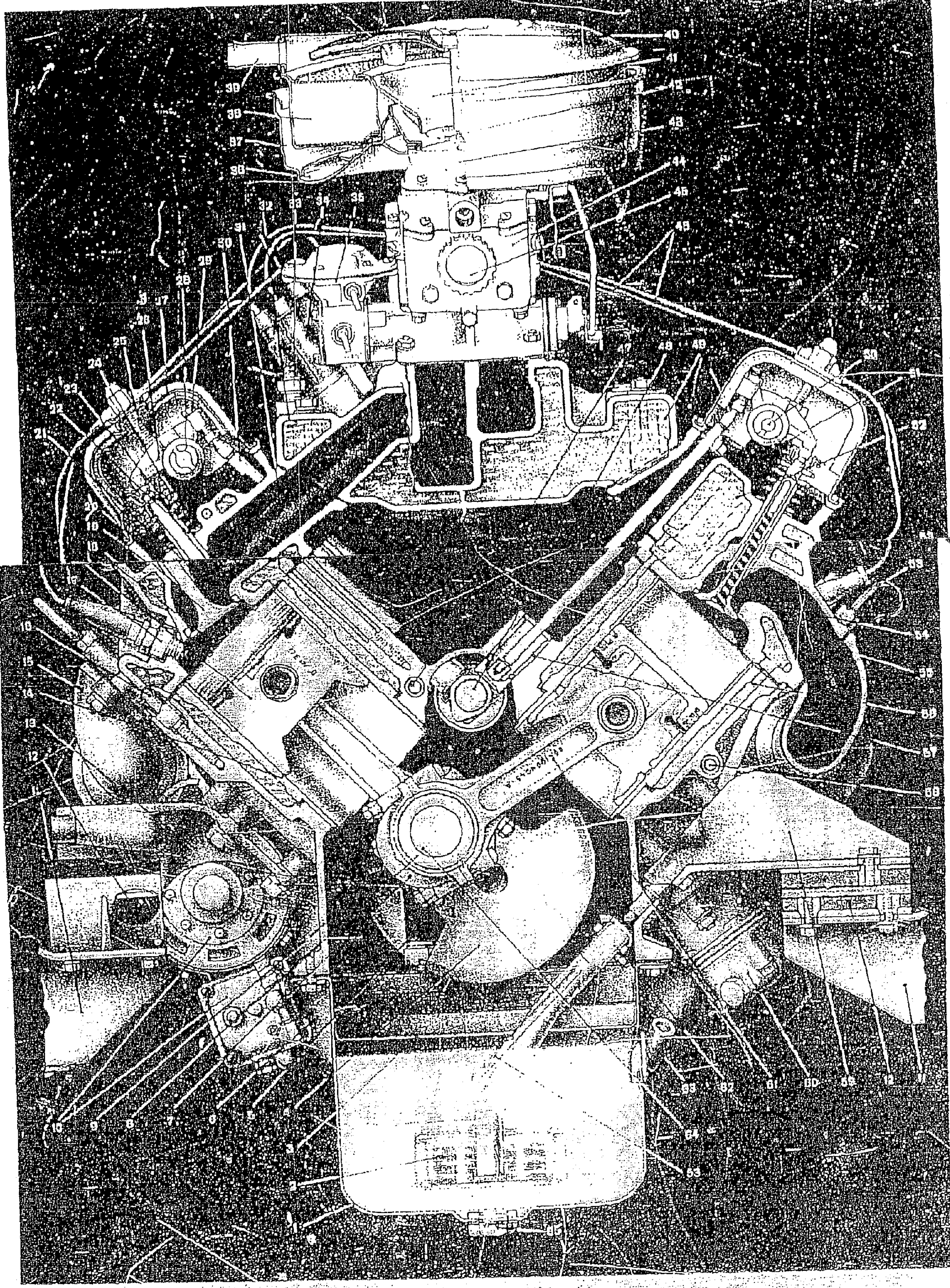
The rear motor mounts consist of bosses (lugs) 66 with apertures for the transmission and flywheel.

The front bracket of the motor rests on two brackets 11 of the frame, while lugs 66 of the transmission and flywheel rest on the second cross member 72 of the frame of the truck. Rubber bumpers 12, 68 and 70 are installed in the motor mounts. The bumpers on the left and right are identical in design.

Front rubber bumpers 12 of the motor mounts are reinforced with steel structures which mate with the threaded lugs mounted within the bumpers.

The motor is mounted in the two rear points with two keyed bolts 71, each of which passes through a bushing and two pairs of round rubber bumpers 68 and 70 (lower and upper), installed in metal mounts.

Care of the motor mounts consists of cleaning the rubber parts to remove oil and dirt, and checking during TO-2 of the condition of the mounts, as well as tightening of nuts and bolts of the mounts as necessary.



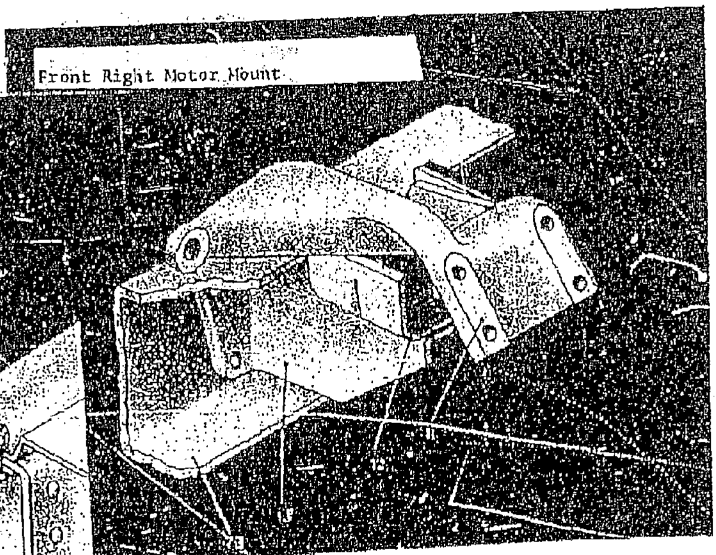
22-a

23-1

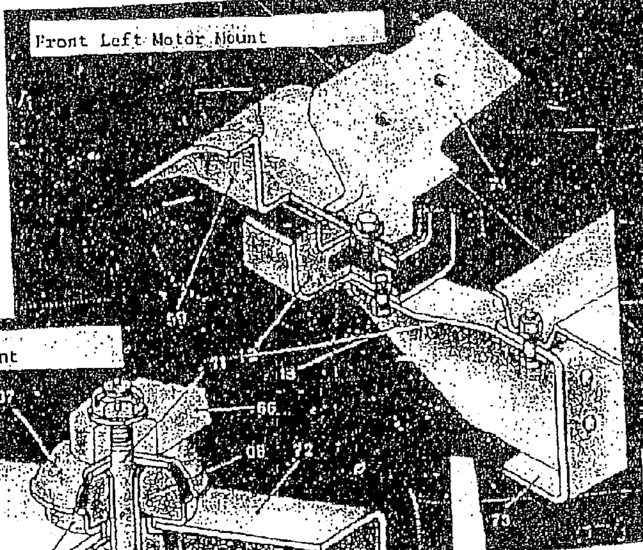
Piston diameter, mm	Liner diameter, mm	Group Symbol
$92_{-0.012}$	$92^{+0.012}_{+0.024}$	A
$92^{+0.012}_{+0.024}$	$92^{+0.012}_{+0.036}$	B
$92^{+0.012}_{+0.036}$	$92^{+0.024}_{+0.048}$	V
$92^{+0.024}_{+0.048}$	$92^{+0.036}_{+0.060}$	G
$92^{+0.036}$	$92^{+0.048}$	D

1 - crankcase
2 - oil pump intake
3 - rear horizontal barrier in crankcase
4 - crankshaft counter weight
5 - main bearing cap
6 - transmission and flywheel housing bottom
7 - connecting rod cap
8 - crankshaft
9 - block
10 - starter
11 - right front motor mount bracket
12 - front mount bracket (rubber reinforced)
13 - right front motor mount bumper bracket
14 - wet cylinder liner
15 - exhaust manifoled
16 - installation lug (with centering bushing) holding down cylinder head
17 - sparkplug
18 - piston
19 - wedge-shaped combustion chamber
20 - cylinder head
21 - intake valve
22 - metal-ceramic bushing
23 - oil-reflector rubber valve cap
24 - valve spring
25 - lug fastening upright for rocker arm shaft
26 - rocker arm
27 - rocker arm cover
28 - rocker arm shaft
29 - valve rocker arm adjustment screw nut
30 - aluminum shaft of lifter with steel tips
31 - intake channel to cylinder
32 - intake manifold
33 - cooling fluid temperature sensor
34 - distributor
35 - governor vacuum actuating mechanism
36 - air filter oil bath
37 - air filter body
38 - capron filtering element
39 - compressor air feed
40 - cover with noise-reducing liner
41 - throat guide tube
42 - intake noise suppressor
43 - carburetor cover flange
44 - carburetor
45 - inspection window for checking fuel level
46 - high voltage wire to sparkplug
47 - main oil channel
48 - cam shaft
49 - intake manifold water jacket
50 - oil channel in valve rocker arm shaft
51 - rocker arm shaft upright
52 - cylinder head water jacket
53 - oil level indicator
54 - exhaust valve
55 - channel for exhaust gases leaving cylinder
56 - cylinder block water jacket
57 - valve lifter
58 - channel for oil feed from pump
59 - left front motor mount bumper bracket
60 - oil pump
61 - connecting rod
62 - oil collecting tube
63 - drain tube from oil radiator
64 - crankshaft big-end journal cavity used for centrifugal oil cleaning
65 - crankcase drain plug
66 - bosses (lugs) of transmission and flywheel
67 - rear mount upper bumper protective cap
68 - rear mount upper rubber bumper
69 - rear mount upper bumper seat
70 - rear mount lower bumper
71 - rear mount fastening bolts
72 - frame cross member
73 - longitudinal frame beam
74 - front motor mount bumper screen

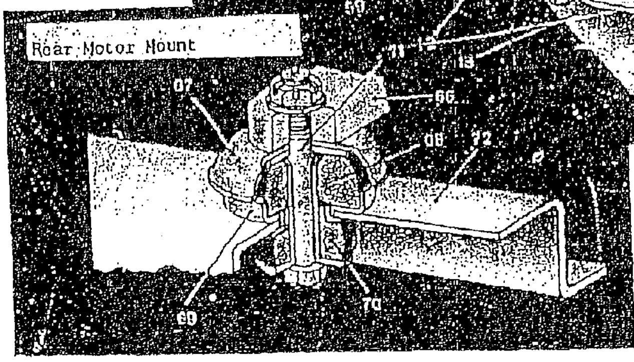
Front Right Motor Mount



Front Left Motor Mount



Rear Motor Mount



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23-2

The Engine Block and Its Parts

Engine block 1 is the body used for installation and fastening of the primary mechanisms and parts of the systems of the engine. The block is cast under pressure of aluminum alloy (type AL-4 silumin) in one piece with the upper portion of the crankcase. Pressure casting assures high block quality and, consequently, reliability of this basic portion of the engine. In order to increase the rigidity of the block, its lower plane of separation is 75 mm below the axis of the crankshaft.

The V-8 placement of the cylinders, in addition to high rigidity and improved gas distribution, allows the use of a comparatively short, light block. The length of the block is 584 mm, its weight, including the cast iron cylinder liners and main bearing caps is 54.5 kg.

Cylinder liners 6 are wet, pressed in. They are made of type SCh24-44 grey cast iron, and inserts 10 of a special acid-resistant austenitic cast iron are pressed into their upper portions to increase wear resistance. The length of the inserts is 50 mm, wall thickness 2 mm. In order to be sure the joint between the internal wall of the cylinder and the insert does not interfere with normal operation of the piston, the cylinder liner face is worked after the inserts are pressed in. The total length of the liner is 155 mm. The liner has two installation belts with a diameter of 100 mm in the lower portion and 108 mm in the upper portion in order to assure proper positioning in the block.

The liners are interchangeable. However, the liners should not be removed from their seats unless necessary, since when the position of the liner is changed, the piston and rings must be run in again.

The liner should fit freely into its seat in the block. There is no need to use force when inserting it, since this will always distort the true cylindrical shape of the liner, resulting in untimely wear of piston rings, high oil consumption and even possibly seizing of the piston.

At the upper portion of the liner there is a flange 5 mm high with an external diameter of 118 mm, which fits into a slot in the upper portion of the block into which the cylinder head fits. The liners are sealed at the top with special head gaskets 29, 1.5 mm thick and made of a special iron-asbestos compound soaked with graphite.

At the bottom there is a circular adjusting and sealing ring 59 of soft type M3 copper between the liner and block (these rings are manufactured in various thicknesses: 0.3, 0.2, 0.15 and 0.1 mm). The upper end of the liner should project above the surface of the block by 0.02-0.09 mm. This dimension must be strictly maintained, since if it protrudes by more than 0.09 mm, it will be deformed after the head is tightened down and will lose its cylindrical shape, while if the protrusion is less than 0.02 mm, the cooling liquid may enter the cylinder. It is very important that the upper end of the liner be parallel to the upper end of the block; the permissible deviation is 0.04 mm.

In order to check the installation, the liner is inserted in the block without the gasket, a straightedge is pressed against the top surface of the block, then a feeler gauge is used to check the clearance between the end of the liner and the straightedge. After the clearance is measured, the required number of sealing rings are inserted.

Heads 32 and 42 are common for the four cylinders of either row. Both heads (except for the lugs screwed into them) are identical. They are cast of type AL-4 aluminum and alloy and fastened to the block with 18 lugs each. Steel cyanided washers are placed beneath the lug nuts.

On the bottom of each cylinder head there are four wedge-shaped combustion chambers. This chamber type provides the best combustion conditions for the fuel-air mixture, preventing detonation.

The intake and exhaust valves are alternated in the cylinder head, eliminating local overheating. The heads are equipped with pressed-in seats 34 and 36 of heat-resistant cast iron and valve guides 48 and 56. Before pressing in, the seats are cooled in dry ice (at -78.5°); the cylinder head is heated to 170°. After installation of the seats, they are ground, then the valves are turned to fit them.

The valve guides are made of metal-ceramic material (pressed, heat treated and oil-saturated mixture of iron, copper and graphite powders), providing high wear resistance of the guide-valve pair. The guides are installed in the head in a manner similar to the seats, i.e., the chilled guid is installed in a heated head. The hole in the guide is finally worked together with the head. The holes for the intake valves are ground out to a diameter of $9^{+0.02}$ mm, for the exhaust valves -- to $11^{+0.022}$ mm.

Above the cylinder head, on lugs screwed into apertures 50, the rocker arm shaft uprights are installed, after which the intake manifold is installed.

Each cylinder head is topped with a valve cover with a rubber gasket. The covers are fastened to the lugs with nuts, beneath which are sealing inserts and special washers.

In the central portion of the block, the cam shaft rides on five bearings. The cam shaft is inserted through aperture 19, its bearings consist of bushings 21, made of wound steel-babbitt strip and pressed into the block. The cam shaft bearing clearance is 0.025-0.067 mm.

The front end of the block is covered with distributing gear cover 22, which rests on a gasket and is fastened to the block by eight lugs. The upper outer portion of the cover forms body 28 of the water pump. Flange 25 of the cover carries the fuel pump, which is driven by an eccentric on the cam shaft. During installation, the cover must be carefully centered relative to the crankshaft axis. This is required for tight, even sealing of the gland installed in aperture 23, and also for reliable operation of the governor sensor, which is fastened to flange 24.

The hollow in the vee of the cylinders contains intake manifold 45, which also acts as a cover over the lifters. The intake manifold is fastened on twelve lugs 35. There are four rubber gaskets between the manifold and the engine: two side gaskets 53, a front and a rear gasket. Intake manifold 45 is a complex casting of AL-4 aluminum alloy. Flange 49 of the manifold carries the carburetor. The intake channels of the manifold which carry the fuel-air mixture are located in two rows. The upper row of channels connects the left mixing chamber of the carburetor with cylinders 2, 3, 5 and 8, while the lower row connects the right mixing chamber of the carburetor with cylinders 1, 4, 6 and 7. The path length of the mixture from the carburetor to any cylinder is thus approximately the same. The manifold design and firing order used decrease pulsations of the stream of mixture in the carburetor and manifold.

The intake manifold also contains a water jacket, consisting of passages, through which the cooling fluid from the block jacket is carried to the exhaust manifold. The liquid from the water jacket of the left cylinder head, passing through the spaces into the right half of the manifold, washes over the channels in its central portion and the cavity of the mixing chambers. This provides for constant and even heating of the fuel-air mixture traveling to the combustion chambers.

The five crankshaft main bearing seats 17 are turned together with their caps 15, 8 and 5, which are made of foundry cast iron. The caps are not interchangeable. They are held tightly in the block by special pins and are fastened by lugs 16, 12 mm in diameter. The nuts which fasten down these caps are tightened with a torque wrench, after which they are pinned with wire. The torque used in tightening is 10-11 kgm. The lower portion of each cap has a threaded aperture for a threaded puller.

The rear end of the crankshaft is sealed with a gland consisting of two half circles of woven, graphite-treated asbestos cord, one of which is placed in a slot in the block, while the other fits in a special gland holder 4, fastened to the block by two lugs. The side slots of the gland holder carry L-shaped seals 3, made of oil-resistant rubber.

The crankcase is fastened to the block by 23 lugs (3 of which are screwed into the distributing gear cover). There is a gasket between the crankcase and block, covered on both sides with glued cardboard.

The transmission and flywheel pan is fastened to the rear end of the block. It is held in place with two pins and is shaped together with the block, so that this pan cannot be shifted from one motor to another.

In order to avoid warping the heads and assure the necessary evenness and tightness of attachment to the block, the head retaining lugs must be tightened with the engine cold in a strictly defined sequence, presented on the Figure. Before tightening the lug nuts holding down the heads, the fluid must be drained from the cooling system and the lug nuts holding down the intake manifold must be loosened (in this case, the two eye-nuts). This is done so that as the nuts are tightened, the intake manifold, which is fastened to both heads, will not be warped, and to avoid leakage of the cooling fluid. To facilitate access to the head retaining nuts, it is recommended that the rocker arm shaft upright nuts be loosened and the uprights and shaft removed.

Tightening should be performed in two passes: first preliminarily, with little force, then finally, as evenly as possible. The operation should be performed smoothly, without jerking, with a special torque wrench allowing the tightening torque to be controlled at 7.3-7.8 kgm.

After tightening the lug nuts holding down the head, the nuts holding down the intake manifold and the rocker arm shaft uprights must be replaced and tightened and the clearances between the rocker arms and valve stems must be checked and adjusted if necessary, since tightening the heads may cause these clearances to decrease, so that the valves do not rest firmly in their seats.

The head lug nuts should be tightened on a new engine, following the first 6,000 km of operation during TO-1, then subsequently each time the head is removed or in case of a leakage of cooling fluid and gas. Before tightening the intake manifold lug nuts, it is necessary to be sure that the cylinder head has been properly tightened. The intake manifold lug

nuts should be tightened in several stages: first, lightly turn the nuts against the gaskets, then hand tighten them in two or three passes, beginning with the center of the intake manifold, then working in a cross pattern alternately on the left and right sides with moderate force. It should be recalled that due to the rubber gasket, the sensation of tightening fully will not be achieved. The nuts should be tightened until the gasket is compressed to 1-1.5 mm thickness.

1 - block
2 - area for installation of oil pump
3 - side rubber seal
4 - rear crankshaft gland holder
5 - rear main bearing cap
6 - cast iron cylinder liner
7 - oil feed line from pump to centrifuge
8 - center main bearing cap
9 - cylinder head lug
10 - cylinder liner insert
11 - area for fastening front motor mount bracket
12 - installation lug (with centering bushing) holding down cylinder head
13 - threaded aperture for tube feeding oil to centrifuge
14 - channel for connection of oil pressure sensor
15 - front main bearing cover
16 - main bearing cap retaining lug
17 - main bearing seat
18 - channel for supply of cooling fluid to left side of block
19 - aperture for installation of cam shaft
20 - main oil channel (formed of steel tube cast in block)
21 - bimetallic bushing for cam shaft bearing journal
22 - distributor gear cover (aluminum alloy)
23 - cranksahft end gland aperture
24 - flange for mounting centrifugal governor sensor
25 - flange for mounting fuel pump
26 - tube delivering cooling fluid to water pump body
27 - tube delivering cooling fluid to right row of cylinders
28 - water pump body formed of distributing gear cover
29 - iron-asbestos block gasket
30 - channel for drainage of oil from centrifuge
31 - wedge-shaped combustion chamber
32 - right cylinder head
33 - aperture for entry of cooling fluid to head jacket
34 - intake valve seat (aperture diameter 46 mm)
35 - intake manifold mounting lug
36 - exhaust valve seat (aperture diameter 35 mm)
37 - channel carrying fuel-air mixture to cylinder
38 - space for installation of oil-filler pipe
39 - flange for installation of centrifuge
40 - channel for oil feed to centrifuge
41 - aperture for mounting power steering pump bracket
42 - left cylinder head
43 - flange for installation of drain tube of engine cooling system
44 - channel for drainage of excess oil from head into crankcase
45 - intake manifold
46 - aperture for cylinder head mounting lug
47 - installation bushing for rocker arm shaft (two each for two rocker arms for each head)
48 - metal-ceramic intake valve guide
49 - carburetor mounting flange
50 - aperture for lug holding rocker arm shaft upright and valve cover
51 - aperture for installation of cooling fluid temperature sensor
52 - intake manifold gasket
53 - channel for passage of valve stems
54 - aperture for attachment of pipe from vacuum brake assist
55 - channel for oil feed to rocker arm shafts
56 - metal-ceramic exhaust valve guide
57 - aperture for installation of sparkplugs, threaded diameter 14 mm
58 - channels carrying exhaust gas from cylinders
59 - copper adjusting and sealing ring beneath cylinder liners

19

Crankshaft-Connecting Rod and Valve Mechanisms of the Engine

Crankshaft-connecting rod mechanism of the engine. Pistons 25 are made of high-silicon aluminum alloy and heat treated. To improve break in to the cylinder liner, the surface of the piston is covered with a thin layer of tin. Piston head 30 is cylindrical, with a flat bottom. The head carries three slots for placement of two compression rings 28 and 26 and one oil scraper ring 24. The lower guide portion of the piston -- skirt 31 -- is oval in shape. It is ground into a conical shape in height, spreading toward the bottom, and has T-shaped notches to compensate for thermal expansion of the skirt. The wrist pin hole is shifted to the right by 1.5 mm (in the direction of travel) from the center of the piston.

The piston rings are made of grey cast iron, individually cast. All rings have a straight cut; The upper compression ring 28 is covered with a thin layer (0.08-0.13 mm) of porous chromium. The outer surfaces of the lower compression ring 26 and oil scraper ring 24 are tinned for better break in (tin layers 0.005-0.010 mm).

The internal surfaces of the compression rings have notches. As the ring operates, it rotates slightly and contacts the surface of the cylinder liner with only a portion of its surface. This improves both break in and the sealing ability of the ring. The rings should be installed on the piston with their end cuts in different areas and with the notches upward.

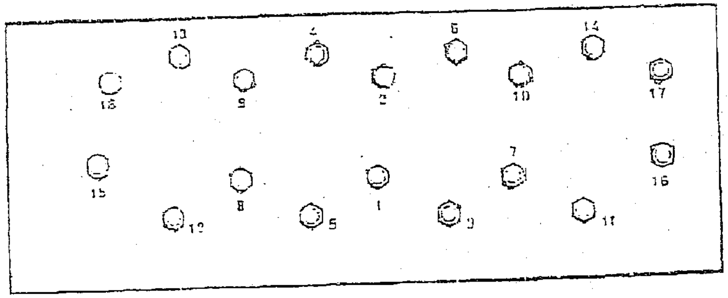
Oil scraper ring 24 has notches and a channel to carry away excess oil removed from the surface of the cylinder liner.

Wrist pin 35 is a steel, floating type, freely rotating both in the connecting rod and in the piston apertures. Its outer surface is hardened to a depth of 1-1.5 mm to HRC 58-65. The wrist pin is blocked from axial movement in the piston by two stop rings.

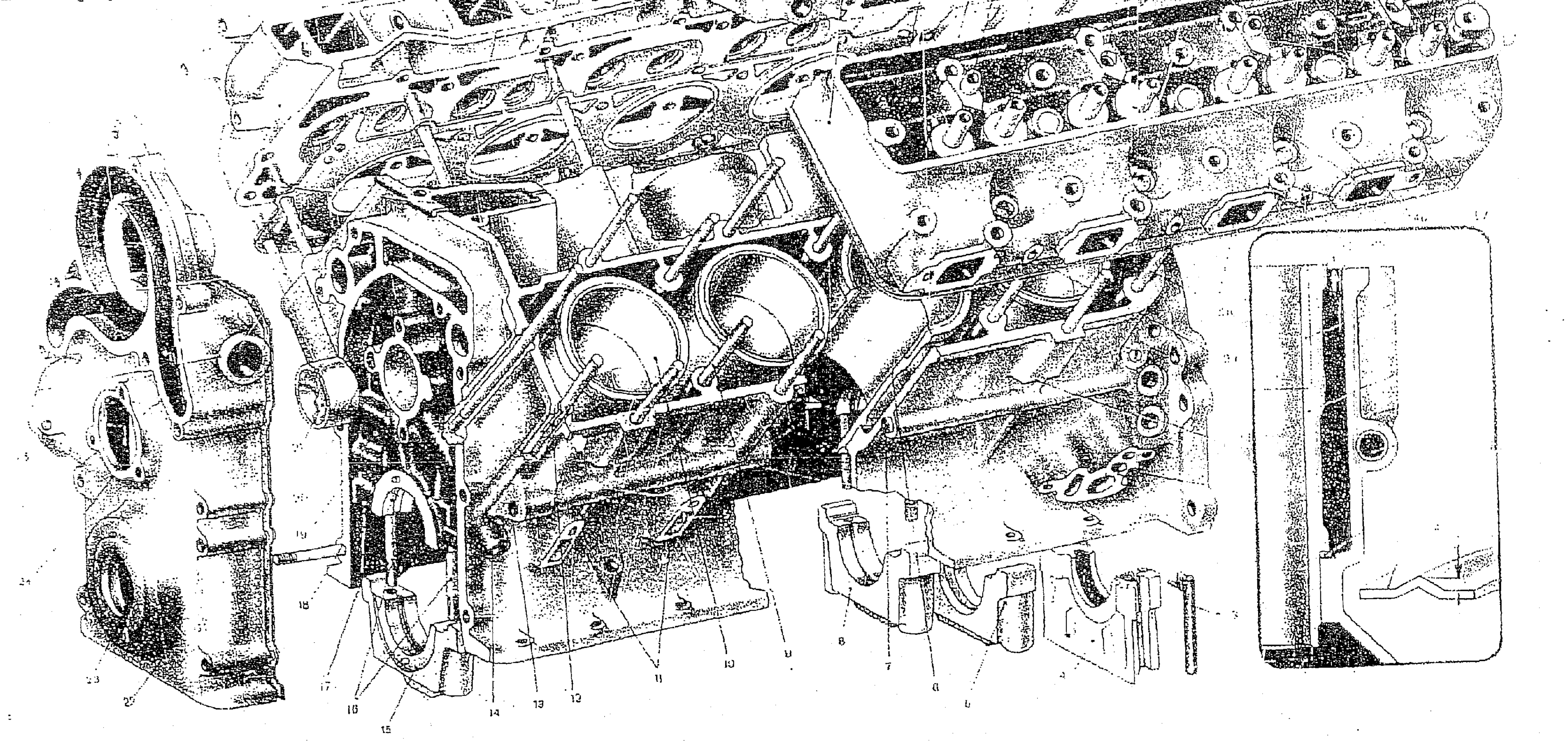
Connecting rods 1 and 33 are forged of type 45G2 steel. The connecting rod shaft has a I-shaped cross section. The little end is not split. A bronze bushing 34 is pressed into the little end to reduce friction. There is a drilled hole in the little end to feed oil to the wrist pin. The split big end has thin-wall, quick-change bushings 4. Cap 5 is fastened to the connecting rod by alloy steel ground bolts 32. Big end caps 5 are not interchangeable; the ordinal numbers of the cylinders are marked on the connecting rod aperture and cap.

The connecting rods are asymmetrical; the big end of the rod is displaced relative to the rod axis (in longitudinal cross section) by 1 mm. The faces on the ends of the big end are larger on one side than on the other. The bushing is shifted toward the smaller face.

Each of the connecting rod necks of the crankshaft carries two connecting rods, with their big end touching each other. During assembly, the two connecting rods are installed with their larger faces out. The part number, stamped on the shaft of the connecting rod, and the small protuberance on the cap (mark) should be turned in the same direction (backward for cylinders 1, 2, 3 and 4, forward for the others).



Location and Order of Tightening of
Head Mounting Lug Nuts



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30-a

The nuts of bolts 32 are torques to 6.8-7.5 kgm.

Connecting rod bushings 4 are made of steel strip with an antifriction layer of high-tin aluminum alloy. The total bushing thickness is 1.75 mm. The bushings have one aperture each. In the upper bushing, the aperture is used to feed oil through the drilled hole in the connecting rod, in the lower bushing it is preserved to maintain interchangeability of bushings. Bushings cannot be adjusted. In addition to the basic size with internal diameter 60 mm, connecting rod bushings are manufactured in nine replacement sizes.

The crankshaft is cast of high strength magnesium cast iron. The shaft has five main bearings (forward main bearing 8, 3 middle main bearings 3 and rear main bearings 66) and four connecting rod necks 2, assuring great rigidity. The diameter of the main bearing necks is 70 mm, of the connecting rod necks -- 60 mm. The main and connecting rod necks are hollow. The internal cavities in the connecting rod necks form centrifugal traps 74, in which the centrifugal forces resulting from rotation of the crankshaft cause additional cleaning of the oil fed to the connecting rod bearings. The rear main bearing 66 of the crankshaft carries oil wiper pattern 67 and oil wiper ridge 71. The front of the crankshaft is sealed with a self-compressing rubber gland, mounted to the distributor gear cover

In order to protect the gland from dust, the hub of pulley 16 carries dust reflector 15, and in order to prevent oil from reaching the gland from gears 13, oil reflector 14. The front main bearing is also a thrust bearing. The axial clearance of the crankshaft should be between 0.075 and 0.175 mm. It is adjusted by selecting the thickness of the front thrust disk 11, which has its antifriction layer turned toward steel ground thrust disk 12. This disk, resting against the bearing, limits the displacement of the crankshaft to the rear. Forward movement of the crankshaft is limited by the thrust of the ground end of the first shaft neck against the antifriction layer of rear thrust washer 7.

Dynamic balancing of the reciprocating and rotating masses of the crankshaft is achieved by means of six counter weights 6.

The crankshaft is twice dynamically balanced: first individually, then assembled with the flywheel and clutch. When necessary, metal is drilled away from the counter weights and flywheel 69, which is mounted by four bolts to flange 68. Flywheel 69 is cast of grey cast iron. One aperture in the flange is drilled asymmetrically, so that the flywheel can only be installed in its balanced position. The flywheel retaining nuts must be torqued to 7.6 - 8.3 kgm.

The main bearings are identical steel thinwall bushings 9 with antifriction layer of babbitt on a metal ceramic sublayer consisting of 60% copper and 40% nickel. The total thickness of the bushing is 2.25 mm. The bushings have a circular channel and two apertures each, through which oil is fed from the main oil channel. The bushings are produced in the basic size with 70 mm diameter and for engine repair (without regrinding the crankshaft) in repair sizes with 0.05 mm less internal diameter. Bushings are also produced for repair with regrinding of the crankshaft in eight replacement sizes with decreases of from 0.25 mm to 2.0 mm at intervals of 0.25 mm. The corresponding marks are stamped into the steel surface of the bushings of repair sizes near the joint.

The bushings are held in their seats against axial displacement and rotation by lugs which enter special slots. Both halves should be replaced in case of wear of the main or big end bearings.

Valve mechanism of the engine. This mechanism assures timely entry of the fuel mixture to the cylinder and removal of exhaust gases from the cylinder.

Cam shaft 38 is a steel forged piece. It is rotated by the crankshaft through a pair of spiral gears, the cam shaft rotating at half crankshaft speed. Textolite driven gear 21 is seated on a steel hub and fastened to the cam shaft by means of a pin and bolt 18. The same bolt fastens eccentric 19, which drives the fuel pump, and its balancer 20, designed to balance the forces of inertia arising during rotation of the eccentric. The marks on each gear must be matched up during assembly.

The cam shaft carries eight cams 42 and 41 for the intake and exhaust valves (intake and exhaust cam profile differ) and gear 62 driving the distributor and oil pump. The cams, bearing necks and gear are induction hardened to a depth of 3-6 mm to hardness HRC 52-60. The cams are ground to a conical shape, which causes tappets 51 to rotate during operation.

The axial movement of the shaft is limited by thrust flange 36, fastened to the front end of the block with two bolts. In order to assure an axial clearance of 0.08-0.2 mm between nonmoving flange 36 and the end of the rotating hub of gear 21, spacer ring 37 is installed at bearing neck 40.

Tappets 51 are steel, plunger type units. Heel 53 of the tappet is cast of white chrome-moly cast iron. Within the tappet is a spherical depression for the lower tip of the lifter and an aperture for drainage of oil from its internal cavity.

Lifters 52 are duraluminum, with steel hardened tips pressed onto the ends.

Shafts 47 of rockers 48 are steel, hollow units. The internal cavity is used as a channel to feed oil to the rocker arms. In order to prevent oil leakage, its ends are closed with plugs. Its friction surface is heat treated to increase wear resistance. Each shaft is installed on four cast iron uprights 49, fastened to the head by lugs.

Rocker arms 48 are cast of steel. A bronze bushing is pressed into the hub of the rocker arm, and carries circular channels on the inside for even distribution of lubricant and lubricant feed into the short end of the rocker arm. The long end of the rocker arm ends in a nose (heat treated spherical surface), which rests on the end of the valve stem. At the end of the short end is a threaded aperture which carries adjusting screw 54. At the lower end of the screw is a spherical depression for the tip of the valve lifter. In the screw there is a longitudinal channel for oil feed to the upper tip of the lifter. Oil reaches the screw from the hollow rocker shaft through a drilled hole in the body of the rocker arm.

The rocker arms are held from logitudinal movement on shaft 47 by spacer springs 50. The end rocker arms are held from displacement by spring washers.

The valves are made of heat-resistant steel (input valve 55 of chrome-silicon steel, exhaust valve 43 of chrome-nickel-manganese steel with nitrogen added). In order to increase the service life of the exhaust valves, their working face is surfaced with VKhN-1 chrome-nickel alloy face 46. The internal cavity of the exhaust valve stem is filled with metallic sodium 44. When the temperature reaches 98°, the sodium melts and, as it moves within the cavity during the motion of the valve, carries heat from the valve face to the stem. The heat is transferred from the stem to the valve guide.

The diameter of the exhaust valve stem is 11 mm, that of the input valve -- 9 mm. The outer diameter of the exhaust valve face is 36 mm, of the input valve face -- 47 mm. All valve stems are installed at an angle of 45°.

Valve spring 57 is made of special heat-treated and shot-peened wire. Its lower end rests on the cylinder head through supporting washer 56, its upper end pushes against plate 59 which is fastened to the upper notch in the valve stem by means of clips 61 and bushing 60. Due to the careful finishing and high hardness of the contact surfaces, the friction between them is so slight that the valve rotates as it operates. This prevents scratching of the valve stem, increases the wear resistance and durability of valves, their seats and guides.

<u>Adjustment of the clearance between rocker arms and valves.</u> The clearance between rocker arms 48 and the end of the valve stems with the engine cold (temperature 15-20°) should be 0.25-0.30 mm for both intake and exhaust valves.

During operation of the engine, various parts are heated to various degrees, which may cause the clearance to change somewhat. As a result, at times valve knock may be heard, which is permissible. If the knock becomes continuous when the engine is warm, most frequently observed in valves located at the ends of the heads, the clearance at the intake valves of cylinders 1 and 8 and the exhaust valves of cylinders 4 and 5 should be decreased to 0.15-0.20 mm.

To adjust the valve clearance of the first cylinder, set the piston at top dead center at the end of the compression cycle. This is done by matching the ball pressed into flywheel 69 with the ignition setting mark in the observation hatch of the clutch housing. At this point, both rocker arms of cylinder 1 should rock freely on their axes.

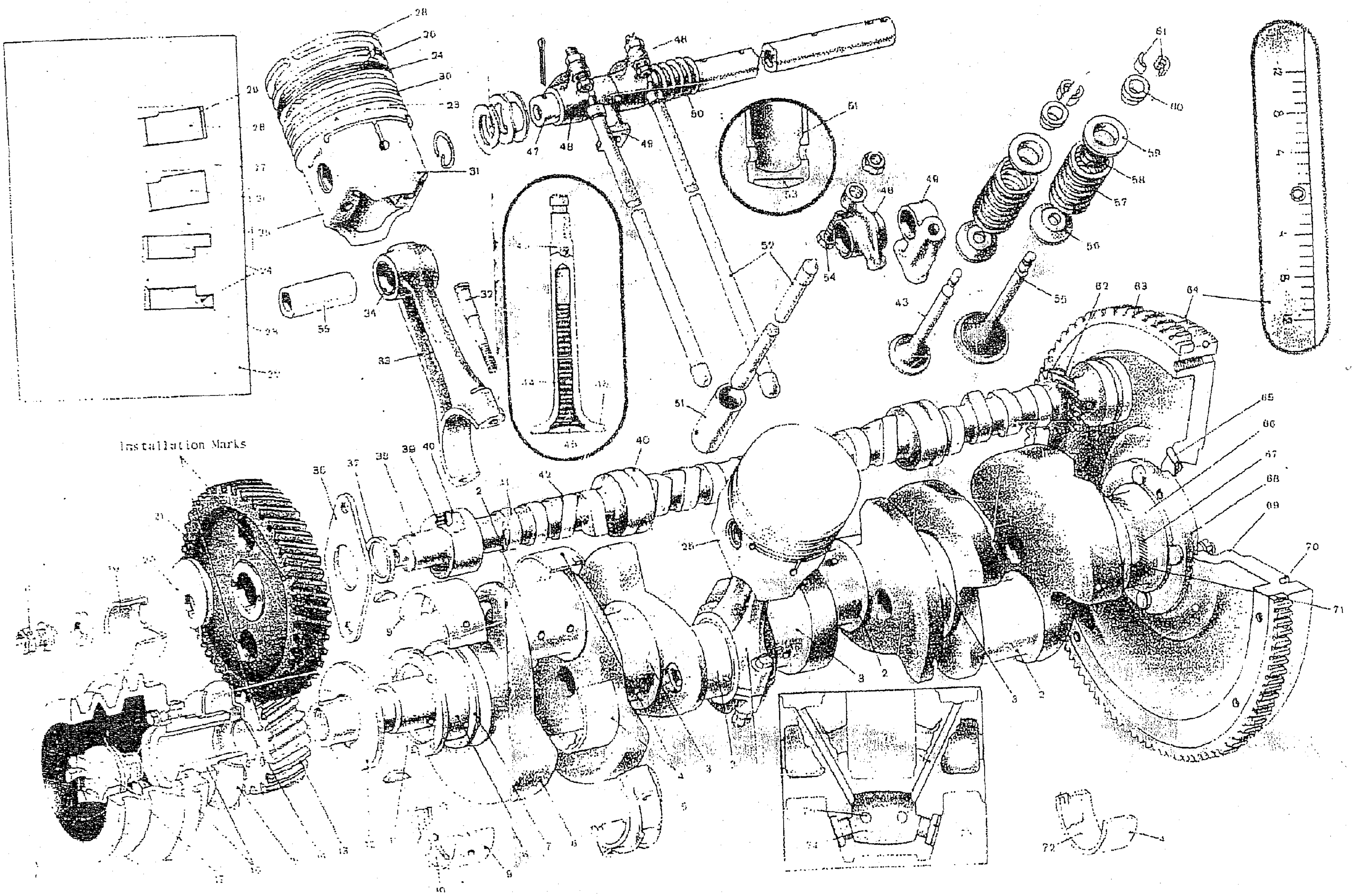
Then, loosen the counter nut on adjusting screw 54 and, by rotating the adjusting screw with a screwdriver, set the clearance to normal using a feeler gauge. Then tighten the counter nut and check the clearance once more. The clearances of the valves of the remaining cylinders are adjusted by the same method in the same sequence as the firing sequence (1-5-4-2-6-3-7-8), by rotating the crankshaft by 90° (one-quarter turn) upon transition from cylinder to cylinder.

1 - connecting rod of left row of cylinders
2 - big-end journal
3 - middle main bearing journal
4 - big-end bearing bushings
5 - big-end cap
6 - counter weight
7 - rear washer of front thrust bearing
8 - front main bearing
9 - main bearing bushing
10 - antifriction layer of main bearing bushing
11 - front disk of front thrust bearing
12 - steel thrust disk
13 - driving gear (30 teeth) of crankshaft
14 - oil reflector
15 - dust reflector of gland
16 - crankshaft pulley with hub
17 - starting lever ratchet
18 - cam shaft gear bolt
19 - fuel pump drive eccentric
20 - eccentric balancer

21 - driven gear (60 teeth) of cam shaft
22 - cylinder liner
23 - channel for oil-scraper ring
24 - oil-scraper ring
25 - piston
26 - lower compression ring
27 - cylinder liner insert
28 - upper compression ring
29 - chromium layer on compression ring
30 - cylinder head
31 - sidewall (skirt) of piston
32 - crankshaft cap bolt
33 - connecting for right row of cylinders
34 - connecting rod little end bushing
35 - wrist pin
36 - thrust flange
37 - spacer ring
38 - cam shaft
39 - channel for oil feed to thrust flange
40 - support neck

41 - exhaust valve cam
42 - intake valve cam
43 - exhaust valve (face diameter 36 mm)
44 - sodium filling (1.85 g)
45 - exhaust valve face plug
46 - heat-resistant surface on valve face
47 - rocker arm shaft
48 - rocker arm
49 - rocker arm shaft upright
50 - rocker arm spacing spring
51 - tappet
52 - valve lifters
53 - tappet face
54 - rocker arm adjusting screw
55 - intake valve (diameter 47 mm)
56 - valve spring support washer
57 - valve spring
58 - oil reflecting valve cap
59 - valve spring plate
60 - valve spring plate bushing
61 - valve spring plate clips
62 - gear (16 teeth) driving distributor and oil pump

63 - flywheel crown (148 teeth)
64 - scale on flywheel for setting of ignition timing
65 - channel for draining excess oil from small bearing of first shaft in transmission
66 - rear main bearing
67 - oil wiping surface
68 - flywheel mounting flange
69 - flywheel
70 - balancing aperture
71 - oil wiping ridge
72 - big-end bearing bushing antifriction layer
73 - big-end journal plug
74 - centrifugal trap for oil cleaning
75 - channel feeding oil to big-end bearing
76 - channel feeding oil from main bearing



35-a

Operating Sequence of the Engine

Sequence of Strokes in Cylinders

The possible periodicity of operating strokes (or other identical cycles) in the cylinders of an 8-cylinder, 4-stroke carburetor-type engine is defined as the result of division of the period of occurrence of an entire operating cycle in the engine, representing 720° of rotation of the crankshaft, by the number of cylinders of the engine. Thus, in the engine of the GAZ-66 truck, the power stroke should begin in one of the cylinders each 90° of crankshaft rotation.

If we assume that the duration of each stroke in a cylinder of the engine is 180° crankshaft rotation, obviously the power stroke occurs simultaneously in two different cylinders of the engine. However, the operating processes in the different cylinders must be displaced relative to each other by 90° crankshaft rotation, i.e., if in one cylinder of the engine (for example, in the first cylinder), the piston in which is located at top dead center (TDC), the power stroke is just beginning, in another cylinder (for example, in cylinder five), the connecting rod of the piston of which is connected to the same crankshaft journal, the compression stroke is still continuing and the power stroke begins in this cylinder only after the crankshaft rotates by another 90°, then continues during rotation of the crankshaft from 90° to 270°.

To provide even loading on the crankshaft, the cylinders of the GAZ-66 are placed in two rows with an angle between the rows of 90°. The right row contains cylinders 1, 2, 3 and 4, while the left row contains cylinders 5, 6, 7 and 8.

The engine uses a five-main bearing crankshaft with four big-end bearings. Two crankshaft big ends from cylinders of the left and right banks are connected to each big-end bearing journal. Thus, the 1st, 2nd, 3rd and 4th crankshaft journals are connected to the big-ends of the connecting rods of the following cylinders: 1 and 5, 2 and 6, 3 and 7, 4 and 8.

The big-end journals of the crankshaft of the engine are placed at angles of 90° to each other evenly (in four directions -- cross-shaped) around the circle described by the crankshaft. In relationship to the first big-end journal of cylinders 1 and 5, the second big-end journal of cylinders 2 and 6 is placed at an angle of 90°, the 3rd journal of cylinders 3 and 7 is placed at an angle of 270° and the 4th journal of cylinders 4 and 8 is placed at an angle of 180°.

The sequence of working strokes in the cylinders of an eight cylinder engine can be traced on the accompanying diagrams and tables.

In constructing the tables it is assumed that the piston of the 1st cylinder of the right bank is at TDC of the compression cycle and in the first 180° of rotation (in the clockwise direction), the power stroke will occur in the first cylinder.

The piston in cylinder 5 in the left bank "lags" by 90°, and the power stroke in this cylinder will occur in the crankshaft rotation interval between 90 and 270°. Consequently, the compression stroke is completed in cylinder 5 during crankshaft rotation interval 0-90°.

The sequence of the operating strokes in the cylinders can be conveniently traced for each bank individually. In cylinders 2, 3 and 4 of the right bank, as the piston of cylinder 1 moves through crankshaft rotation 0-180° or 90-270°, the following operating processes occur.

The piston of cylinder 2 moves downward during rotation 0-90° (of 1st journal); at this time, the intake cycle is completed, and during the 90-270° interval, the piston of cylinder 2 moves upward in the compression cycle.

The piston of cylinder 4 moves upward during rotation intervals 0-180°; this is the compression stroke.

The piston of cylinder 3 moves upward in the 0-90° rotation interval, completing the exhaust cycle, then moves downward during rotation interval 90-270°, in the intake cycle.

The cylinders of the left bank are displaced (lag) in relationship to the cylinders of the right bank by 90° and, consequently, all processes in these cylinders occur with a "delay" of 90°.

As we have already established, in cylinder 5 in the left bank, the compression cycle is completed during rotation interval 0-90°, the power stroke occurs during the 90-270° rotation interval, and the following processes occur in cylinders 6, 7 and 8 of the left bank.

The piston of cylinder 6 moves downward in interval 0-180°, in the intake cycle.

The piston of cylinder 8 moves downward in the 0-90° interval, completing the power stroke, then the piston of cylinder 8 moves upward in the 90-270° interval, in the exhaust stroke.

The piston of cylinder 7 moves upward in the 0-180° interval, in the exhaust stroke.

The further sequence of strokes in the cylinders of the engine can be constructed using the sequence of occurrence of the four-stroke operating process and assuming that each stroke in each cylinder requires 180° of crankshaft rotation.

Analysis of the tables presented indicates that the sequence of power strokes or other identical strokes in the cylinders of the engine is as follows: 1-5-4-2-6-3-7-8.

This sequence of occurrence of identical strokes in the cylinders provides even loading on the crankshaft and parts of the engine and helps to solve the problem of balancing the forces of inertia of the reciprocating masses.

Phases of Gas Distribution

Good filling and complete purging of the cylinders is assured by proper selection of the shapes of intake and exhaust cams on the cam shaft, which also determine the phases of gas distribution in the engine. Therefore, the intake and exhaust strokes in the engine are actually longer than the compression and power strokes.

The process of intake of the fuel mixture into the cylinder of an engine (beginning of opening of intake valve) begins before arrival of the piston at top dead center (TDC) by 24° of rotation of the crankshaft; this process ends (intake valve closes) some 64° of crankshaft rotation after the piston has reached bottom dead center (BDC). Thus, the actual intake stroke continues for 268° of crankshaft rotation.

The process of exhausting spent gases begins before the power stroke is completed; the exhaust valve opens some 50° before the piston reaches BDC, and this process continues until 22° after the piston has passed TDC. Thus, the exhaust stroke continues for a total length of 252° crankshaft rotation.

Therefore, the intake and exhaust cams have different profiles. They are cast as a single piece with the cam shaft, with their protruding portions located around the circumference of the shaft in correspondence with the order of operation of the cylinders used.

The duration of the compression cycle in the cylinder is determined by the moment when the intake valve closes and the beginning of ignition of the fuel mixture in the cylinder. Early ignition of the mixture in the cylinders (before TDC) assures complete combustion, but presents a danger of the appearance of additional loads and knocking in the cylinders. Late ignition (after TDC) is used when low quality fuel must be burned; this decreases the power and economy of the engine and may cause it to stop. The moment of ignition of the fuel mixture in the cylinders of the engine is adjusted when it is installed. The duration of the power stroke is reduced by the fact that the exhaust valve is opened before the piston reaches BDC.

We can see from the diagram of the phases of gas distribution that for 46° of crankshaft rotation, both valves are open -- the exhaust valve has not yet closed, while the intake valve has already opened; this is referred to as the period of valve overlap. As valve overlap increases, the quality of purging of the cylinders and volumetric efficiency increase, but there is a danger that the engine may stop, particularly if low-grade gasoline is used.

These phases of gas distribution of the engine relate to a clearance between valve and rocker arm of 0.35 mm; changing the valve clearance causes corresponding changes in these phases.

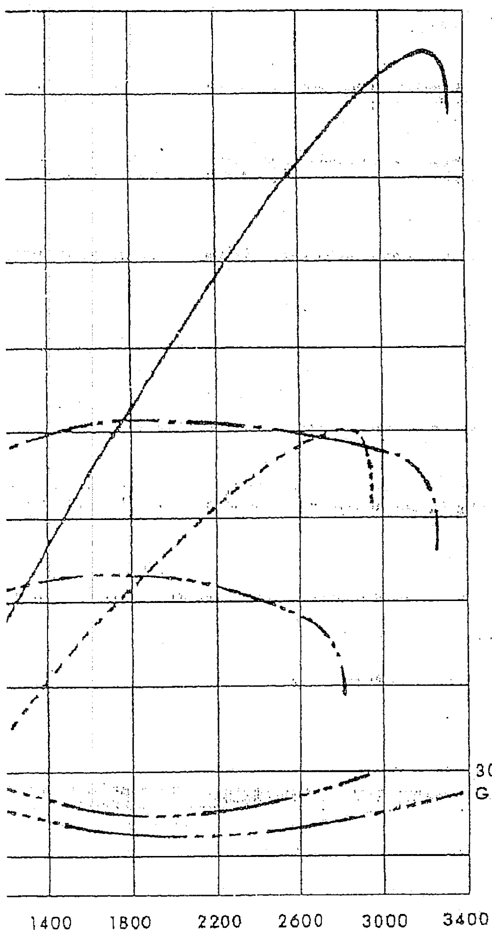
Proper setting of the phases of gas distribution also requires that the cam shaft gear (with which the shaft is connected by a pin in a strictly fixed position) be meshed with the crankshaft gear with the marks accurately aligned. The marks must be aligned on a straight line connecting the centers of the gears.

Performance characteristics of the engine. The graphical expression of the effective power (in hp), torque (in kg-m)   on the crankshaft and specific fuel consumption (in g/ hp·hr) of the engine with throttle wide open as a function of rotating speed in rpm is the performance curvve   : of the engine. Comparison of the characteristics of the GAZ-66 and GAZ-63 engines indicates that the performance of the GAZ-66 engine is significantly better than that of the GAZ-63 engine.

The maximum power developed by the GAZ-66 engine (limited by govornor) is 115 hp at 3,200 rpm, the maximum torque is 29 kg-m at 2,000-2,500 rpm, the minimum specific fuel consumption per hp·hr is 230 g at 1,800-2,200 rpm.

The specific fuel consumption increases significantly when the rotating speed of the engine is either increased or decreased, and may exceed 250 g/hp-hr.

ERNAL CHARACTERISTICS OF GAZ-66 AND GAZ-63 ENGINES



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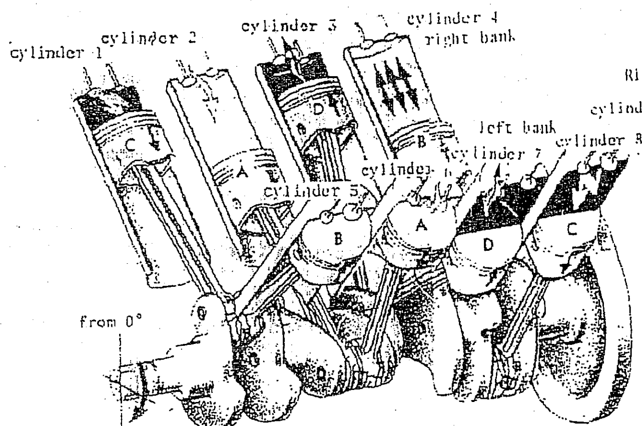
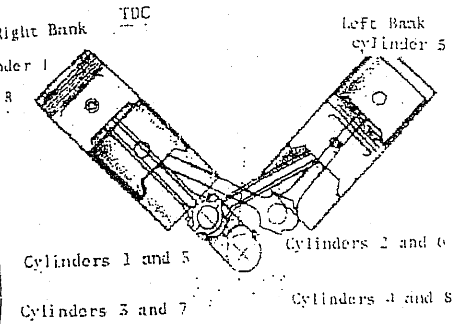
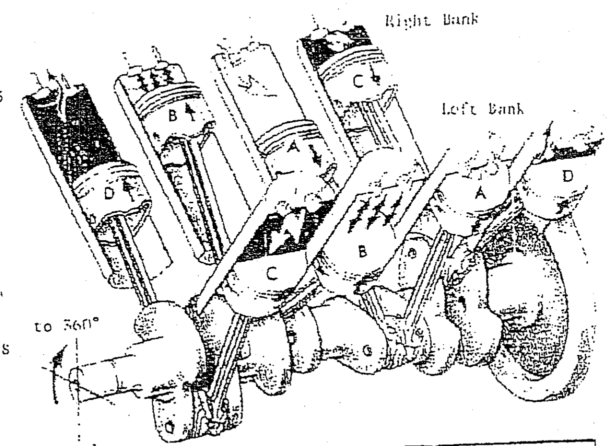
JEL CONSUMPTION



First Half Cycle of Crankshaft Rotation (0—180)

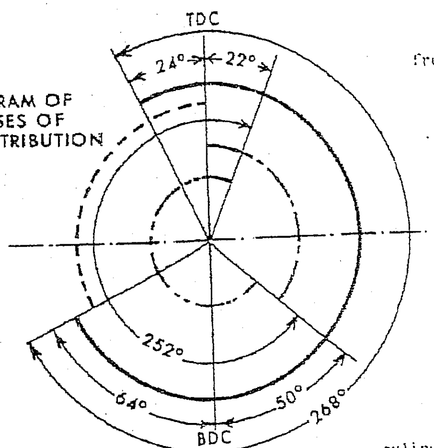
crankshaft rotation,	Processes Occurring in Cylinder 1	2	3	4	5	6	7	8
from 0 to 90°	C	A	D	B	B	A	D	C
from 90 to 180°	C	B	A	B	C	A	D	D

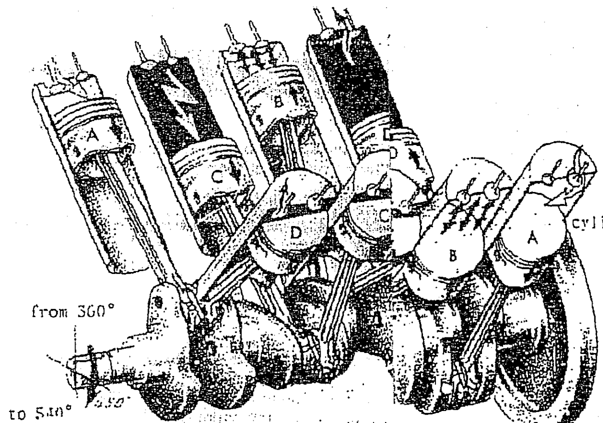




crankshaft rotation,	Processes occurring in cylinders 1	2	3	4	5	6	7	8
from 180 to 270°	D	B	A	C	C	B	A	D
from 270 to 360°	D	C	B	C	D	B	A	A

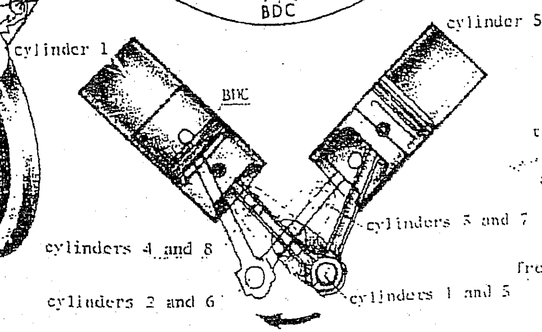
DIAGRAM OF PHASES OF GAS DISTRIBUTION



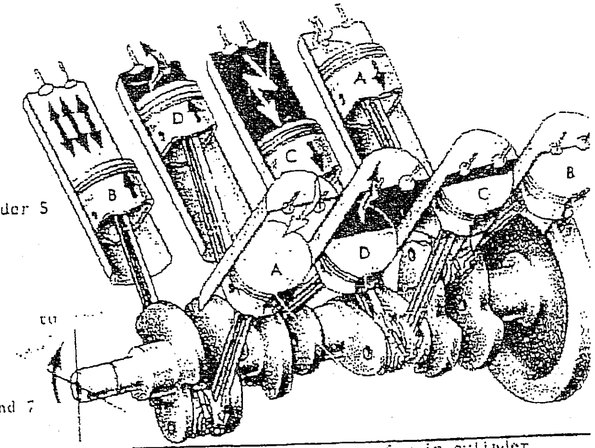


Third half Cycle of Crankshaft Rotation (360—540)

crankshaft rotation,°	Processes occurring in cylinder 1	2	3	4	5	6	7	8
from 360 to 450°	A	C	B	D	D	C	B	A
from 450 to 540°	A	D	C	D	A	C	B	B



LEGEND
A INTAKE
B COMPRESSION
C POWER
D EXHAUST



crankshaft rotation,	Processes occurring in cylinder 1	2	3	4	5	6	7	8
from 540 to 630°	B	D	C	A	A	D	C	B
from 630 to 720°	B	A	D	A	B	D	C	C

20

20 a

The Lubricating System of the Engine

Basic Data

Lubricating system -- combined: pressure, spray and gravity flow;
Oil Pump -- gear type, two-section;
Oil filter -- centrifugal, included in lower section of oil pump and screen, installed in pump oil pickup;
Oil radiator -- tubular, single-row, with air cooling;
Total capacity of lubricating system -- 8 l;
Oil change interval:
under normal road conditions -- each 3,400 km,
when operating over dirt roads and cross country -- each 2,200 km.

The lubricating system of the engine feeds oil to the friction surfaces of parts in order to decrease friction losses between them; the oil also cools parts and removes wear products from their surfaces. Furthermore, the oil layer formed at the edges of the piston rings, between the piston and the cylinder helps to improve the seal between piston and cylinder.

The lubricating system of the engine consists of non-moving oil pickup 4, two-section oil pump with upper section 70 and lower section 71, the system of oil channels and apertures in the primary parts of the engine, centrifugal oil filter (centrifuge) with cover 39, two reduction valves 75 and 92 (one on the oil pump in the main line feeding oil to the centrifuge, the other at the end of the main oil line), tubular oil radiator 21, oil crankcase 7 and oil filler pipe 34 with crankcase ventilation filter.

The pressure in the lubrication system, as the vehicle drives at moderate speeds under normal temperature conditions, is maintained at between 2.5 and 4 kg/cm^2. When the engine is cold, it may reach 5-5.5 kg/cm^2, and in hot weather, due to thinning of the oil, it may drop to 1.5 kg/cm^2.

There is a special device consisting of sensor 11, screwed in through a plug in the end of the transverse, inclined oil channel 19, and a red warning light with the word "oil" written on it on the dashboard, to warn of defects in the lubricating system. If the oil pressure drops to between 0.4 and 0.7 kg/cm^2, this warning lamp lights. If the lamp lights as the engine is turning at moderate speeds, this means there is a defect in the lubrication system. The engine must be stopped until the defect is located and repaired.

The test lamp may light at low idle speeds of the engine. If the lubricating system is in good condition, the lamp will go out when the engine speed is increased.

Since the truck carries no oil pressure gauge, the oil pressure in the lubricating system must be tested with a separate pressure gauge, connected in place of sensor 11.

As the engine operates, a portion of the oil on the cylinder liner 44 will reach the combustion chamber, where some of the oil will be burned by the high temperatures; this burned oil, together with resinous fuel deposits and combustion products, forms a hard coke-like material called scale. Varnish deposits are also formed on the piston and piston rings as a result of oxidation of a thin layer of oil and the action of high temperatures. The oil loss varies, depending on the condition of the engine and operating conditions of the truck. A new engine will consume an average of 250 g oil per 100 km. As it is used and the parts break in, engine oil consumption decreases to 100 g per 100 km, then increases once more as the parts wear further. This process is faciliated by wear of cylinder liners, as well as wear (and in some cases burning or breakage) of piston rings.

The main reasons for high oil consumption, in addition to burning in the combustion chambers due to the factors outlined above are:

oil leakage through seals and leaks resulting from great wear of engines or defects in the crankcase ventilation system, resulting in the development of high pressure within crankcase 7;

pumping of oil into the intake manifold 41 through the rubber seals between the manifold and head 52;

sucking of oil into the combustion chambers through worn valve guides 59.

The oil is pored into crankcase 7 through oil filler pipe 34, located in the front portion of the engine. Before pouring in oil, crankcase ventilator filter 38 must be removed.

The oil level is checked by the mark on the dipstick 6, which is set in a special tube on the left side of the engine. The "P" mark on the dipstick indicates the maximum level of oil, the "O" mark indicates the minimum level. The oil level should be kept near the "P" mark. It must be kept in mind that the oil level may be somewhat over the mark after the truck has been parked for some time. This results from draining of the oil from the channels in the block, oil radiator, oil filter and compressor into the crankcase. In order to determine the oil level precisely, start the motor and allow it to run for several minutes. The oil level should be measured 3 to 5 minutes after the motor is stopped. To do this, remove and wipe off the dipstick with a rag, insert it fully, remove it again and note the oil level on the dipstick. If the oil level is significantly below the "P" mark on the dipstick, oil should be added to return the level to this mark. If the oil level is significantly higher than the "P" mark, the big-ends of the connecting rods will begin to touch the surface of the oil as they spin, forming a thick oil fog in the crankcase. This oil fog will leak through the piston rings (particularly in a worn engine), causing the sparkplugs to become fouled, forming scale on the bottoms of pistons 45 and the walls of the combustion chambers in block 52, and coking up the piston rings. The engine will smoke, and the oil consumption will increase.

If the oil level falls below the "O" mark, the engine must not be used, since at this level oil is no longer fed to the lubricating system, which will cause serious damage: melting of the bushings in main bearings 83 and big-end bearings 85, scratching of the friction surfaces, seizing of parts, etc.

Crankcase 7 is stamped of sheet steel. The crankcase is fastened to the block through a gasket on 23 lugs, three of which are screwed into the distributing gear cover. In order to prevent sloshing of the oil during braking of the truck and movement on poor roads, baffles 10 and 79 are installed in the front and rear of the crankcase.

The oil is sucked into the lubricating system through the oil pickup, fastened rigidly to the block through its tube 2 by a flange. In order to prevent entry of large foreign objects into the lubricating system, the oil pickup is equipped with screen-type filter 3. If the filter becomes plugged, the oil can pass through a circular slit between the body of the oil pickup and the screen.

To remove the oil pickup, unscrew the nut mounting the oil pickup tube flange. To remove screen filter 3, loosen the spring which mounts its body to the tube. When installing an oil pickup, be sure that there is a gasket on the pickup tube flange. This gasket prevents air from being sucked into the lubricating system.

Centrifugal traps 81 in the big-end journals of the crankshaft are included to improve the cleaning of the oil. The centrifugal force which arises as the crankshaft rotates causes heavy particles in the oil and wear products to precipitate in these traps. The cavities in the crankshaft journals are sealed with plugs 84, which are threaded and cored.

Each time the bushings are replaced, and any other time when the engine is dissembled, the cavities in the crankshaft big-end journals must be cleaned out. This is done by withdrawing all trap plugs and removing the deposits using a scraper or brush. The cavities and oil channels are then washed with kerosene, then blown out with air, after which the plugs are screwed back in and punched. The traps must be very carefully cleaned, since any remaining dirt will be carried by the oil to the big-end bearings and may cause scratching and excessive wear.

The oil arriving at the friction surfaces not only lubricates, but also cools them, significantly heating the oil. When the oil reaches a temperature of over 105-110°, it loses much of its lubricating ability. Sometimes, the cooling of the oil in the crankcase of an engine and centrifugal filter is not sufficient to restore these properties; therefore, the lubrication system includes a tubular oil radiator, tubes 21 of which are cooled by an air stream.

The oil radiator consists of two tanks -- receiver tank 23 and drain tank 20, which have flanges into which tubes are soldered for delivery and return of the oil. The tanks are connected by six horizontal brass tubes 21. To improve heat transfer, cooling plates 22 are soldered to the tubes. The tanks are connected by strips terminating in brackets for mounting of the oil radiator. The radiator is fastened to the brackets by four bolts welded to the front of the grill in front of the radiator of the cooling system.

The supply hose 24 of the oil radiator (on the right side of the engine) connects to valve 87, with which the radiator can be connected or disconnected. The valve is screwed into body 86 of safety valve 89. When the radiator is turned on, the lever on valve 87 is aligned with the hose.

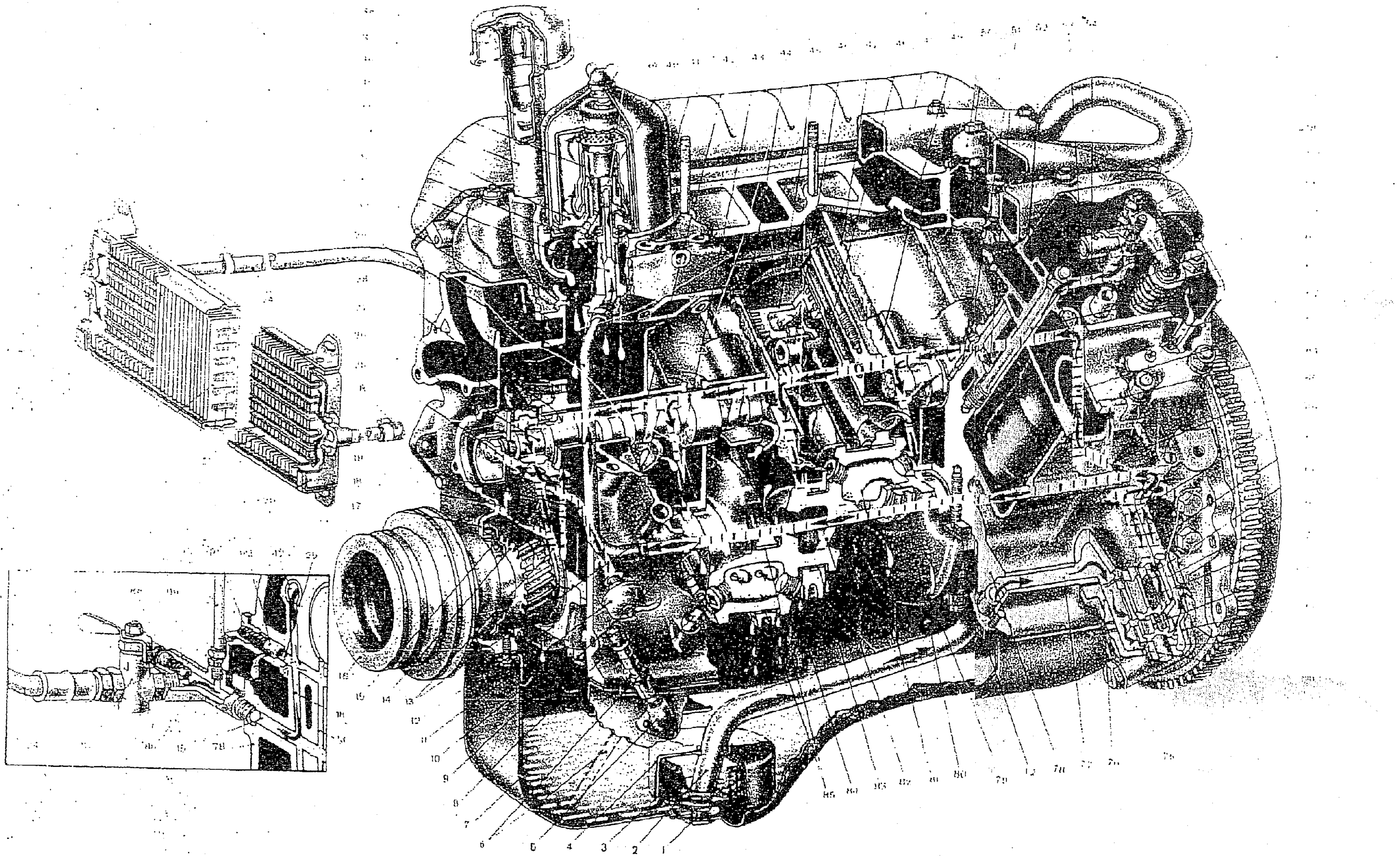
The oil radiator valve need be opened only when the surrounding air temperature is over 20°. At lower temperatures, the radiator should be disconnected. However, when operating under very severe conditions with high loads at low speeds, the oil radiator must be turned on, regardless of the outside air temperature.

Oil is drained from the radiator through hose 8.

Safety valve 89, through which the oil passes to the radiator, opens when the pressure in the oil line reaches 0.8-0.9 kg/cm^2. If the pressure in the line exceeds 1 kg/cm^2, the valve opens fully. At pressures of less than 0.8 kg/cm^2, oil does not circulate through the radiator even if valve 87 is open. Thus, oil does not circulate through the radiator when the engine is operating at the idle, when the thermal state of the engine does not require oil cooling. This guarantees continual lubrication of the main and big-end bearings, since at low oil pressure instead of going to the friction surfaces, the oil might otherwise go through the oil radiator.

Care of the oil radiator consists in testing the tightness of seal of the oil line joints, washing the radiator and cleaning of hoses. Washing of the radiator should be performed with the hoses disconnected from the radiator with liquid oil, by passing it through the radiator under pressure in the direction opposite to normal circulation.

1 - crankcase drain plug
2 - oil pickup tube
3 - screen filter
4 - oil pickup body
5 - oil radiator return line
6 - oil level indicator
7 - crankcase
8 - hose for return of oil from oil reducer
9 - oil line for feeding oil to centrifuge
10 - front horizontal crankcase baffle
11 - oil pressure warning light sensor
12 - main bearing cap
13 - channel feeding oil to main bearings
14 - crankshaft gear (30 teeth)
15 - channel feeding oil to oil radiator
16 - crankshaft pulley
17 - distributor gear cover
18 - channel feeding oil to front journal of cam shaft
19 - channel feeding oil to oil pressure sensor
20 - oil radiator drain tank
21 - oil radiator line
22 - plate transmitting heat from tube
23 - oil radiator receiving tank
24 - hose feeding oil to radiator
25 - line feeding oil to oil pressure sensor and reducing valve
26 - cam shaft
27 - line feeding oil to supporting flange
28 - cam shaft supporting flange bearing
29 - line feeding oil to centrifuge
30 - chamber for drainage of oil into crankcase
31 - channel feeding oil to centrifuge
32 - rotor sprayer
33 - centrifuge rotor
34 - oil filler pipe
35 - rotor guide cup
36 - oil reflector
37 - filter element
38 - crankcase ventilation filter body
39 - centrifuge cover
40 - hollow rotor shaft
41 - intake manifold
42 - main oil line
43 - channel feeding oil to cam shaft journal
44 - cylinder liner face
45 - piston with piston rings
46 - wrist pin
47 - valve lifter rod
48 - connecting rod
49 - tappet
50 - body of crankcase ventilation pipe
51 - channel feeding oil to rocker arms
52 - head
53 - oil channel in rocker arm shaft
54 - channel feeding oil to rocker arm shaft
55 - crankcase ventilation pipe
56 - channel feeding oil to valve stem
57 - rocker arm
58 - circular oil channel in rocker arm upright
59 - intake valve guide
60 - valve spring
61 - space through which oil is fed to rocker arms
62 - channel for drainage of excess oil
63 - vertical channel feeding oil from pump to main engine parts
64 - channel feeding oil to cam shaft
65 - horizontal channel feeding oil from pump to main engine parts
66 - channel feeding oil to main oil line
67 - channel feeding oil to centrifuge
68 - channel feeding oil from upper pump section
69 - channel feeding oil from lower pump section
70 - upper section of oil pump
71 - lower section of oil pump
72 - body of lower pump section
73 - driving shaft of pump
74 - channel feeding oil to pump sections
75 - reducing channel in lower pump section
76 - body of upper pump section
77 - channel feeding oil to pump
78 - block
79 - rear horizontal crankcase baffle
80 - crankshaft
81 - centrifugal trap for cleaning of oil
82 - channel feeding oil to big-end journal
83 - main bearing bushing
84 - centrifugal trap plug
85 - big-end bearing bushing
86 - safety valve body
87 - oil radiator valve
88 - safety valve body plug
89 - oil radiator safety valve
90 - tube feeding oil to compressor
91 - reducing valve plug
92 - main oil line reducing valve



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45-a

Lubrication System Devices

Oil pump. The oil pump is a two-section, gear-type pump. It is installed on the left rear portion of the block and is fastened to it by two lugs.

The pump is driven by steel cyanided gear 16, which drives the distributor and oil pump; this gear is in constant mesh with the cam shaft gear. Gear 16 is fastened by a pin onto the lower end of shaft 21 which drives the distributor. At the upper end of the shaft is a slot into which the lower end of the shaft from the distributor fits. The slot is displaced by 0.8 mm from the axis of the shaft; therefore, its bottom end can be set only in one, strictly fixed position. Guide bushing 23 is attached to this end of the shaft with a pin.

Bronze 17 and hardened steel 18 thrust disks are installed between drive body 22 and gear 16. Shaft 21 rotates in two bushings 24, made of sheet bronze and pressed into the body. The rotation of the oil pump is transmitted through intermediate hexagonal shaft 15, which fits into hexagonal apertures in shaft 21 (where it is held by a pin) and oil pump drive shaft 10.

Driving gear 14 of the upper (main) section is pressed onto shaft 10 and held by pin 29. Driving gear 27 of the lower (supplementary) section is seated on key 28 on the same shaft. Driven gears 5 and 12 rotate freely on their shafts 4 and 9, pressed into the aluminum bodies of upper section 13 and lower section 1. Each gear has 7 straight-cut teeth.

Between the sections of the pump is cast iron barrier 26, sealed with paronite gaskets on each side. In order to assure the necessary clearances between the ends of the gears and the barrier, the thickness of the gaskets should be between 0.3 and 0.4 mm. Increasing the clearances by installing a thicker gasket results in a decrease of pump delivery and therefore a reduction of the oil pressure. Decreasing the clearance by installing gaskets less than 0.3 mm thick increases gear wear.

The body of the upper section of the oil pump has three channels. The oil arrives to the pump from the oil receiver through channel 7, while channels 11 and 6 are used to deliver oil to the main oil line from the upper and lower sections. All channels in the oil pump match the corresponding channels in the block.

The oil arriving from the crankcase passes through channel 7 to the intake cavity of the pump, then enters the spaces between the teeth of the rotating gears, from which it is moved to the delivery cavities of the upper and lower sections. At the points where the gear teeth mesh, they block the oil from returning to the intake cavity.

A pressure is created in the delivery cavities, causing the oil to flow out of the upper section of the pump through channel 11 into the main oil line to lubricate the friction surfaces, while the oil from the lower section is directed through channel 6 to the main line to the centrifugal oil filter.

This assures constant pressure of the oil before the centrifuge, guaranteeing stable operation of the filter regardless of the wear of the engine.

Body 1 of the lower section contains plunger-type reducing valve 3, to which the oil is fed through channel 2. This valve controls the oil pressure in the main line of the centrifugal oil filter, which must be between 3.5 and 4.5 kg/cm^2 at 2,000 rpm. The reducing valve 3 begins to operate at a pressure of 3.6 kg/cm^2. The valve opens fully at a pressure of 4.5 kg/cm^2. A portion of the oil is then bypassed into the intake cavity, thus circulating within the oil pump.

The upper and lower sections of the oil pump have considerably higher delivery than is required for ordinary operation of the engine. This is done to assure the necessary oil pressure at any operating mode, and even with significant wear of engine parts, causing increased oil flow.

The pump requires no special care of adjustment.

After dissembly or upon replacement of the oil pump, it must be filled with oil before being replaced on the engine, since a "dry" pump will not begin operating, causing damage to the bearing bushings. The pump is installed on the engine at a slant, so that the oil cannot drain from it when the engine is stopped.

Centrifugal oil filter. The lubrication system of the engine includes a centrifugal oil filter (centrifuge), connected parallel to the main oil line, in order to remove mechanical parts and oxidation products from the oil. This filter is called a partial-flow filter, since only a portion of the oil delivered by the pump flows through the centrifuge. The filter is mounted on the upper front section of the intake manifold. The oil is fed to this filter from the lower section of the oil pump through a special channel on the left side of the block and through a tube in the left front portion of the engine connected to nipple 49.

The filtering element of the centrifuge is plastic rotor 53, fastened onto hollow shaft 45, installed on two bronze bushings 44 and thrust ball bearing 48. The filter space of the rotor body is limited by cap 33, installed on rubber ring 32 and fastened to the rotor shaft by means of circular nut 37. The top of the rotor is closed by cover 38, fastened to the shaft by wing nut 39. The cover is installed on intake manifold 30 and sealed by means of rubber gasket 55.

At the base of the rotor are two jets 51, the delivery calibrated apertures of which have a section of $1.9^{+0.05}$ mm. These apertures are pointed in opposite directions and are located at the same distance from the rotor shaft. The jets of oil leaving them in opposite directions create a reaction torque which spins rotor 53 at high speed.

The oil from the lower section of the pump passes through hollow shaft 45 under pressure, then through apertures 46 in the shaft and channel 47 in the plastic rotor rod and fills the space beneath cap 33. Then the oil passes through filter screen 35, through the apertures in rotor 53 to the two jets 51 and is sprayed out of them. Cup 34 forms a central collecting column within the rotor, containing the cleanest oil; filter screen 35 also retains suspended particles, protecting the jets from plugging.

Cap 33 and the oil in the cavity between the rotor and the cap rotate together with the rotor. The heavy particles which contaminate the oil are thus moved by centrifugal force to the inner surface of the cap, to settle there as a dense precipitate.

The clean oil ejected through the sprayers flows down into the distributing gear cover and on into the crankcase, lubricating the case distribution gears on the way.

The flow rate through the centrifuge with an oil pressure of 4.5 kg/cm^2 in the filter line and a centrifuge rotation rate of 7,700 rpm is 8 l/min.

Maintenance of the centrifugal oil filter. To assure normal operation of the filter, it must be cleaned of sediment and dirt each time the oil is changed in the engine. Cleaning should be performed after the oil drains fully from the filter, i.e., at least 30 minutes after stopping the engine. Removal of the filter cover before the oil has drained fully may cause oil to leak out and dirty the engine. The filter is cleaned in the following sequence:

remove the crankcase ventilation filter from the oil filler pipe, as it would otherwise be in the way; remove wing nut 39 and cover 38 of the centrifugal oil filter, remove circular nut 37 which prevents rotation of the cap and carefully remove the cap by its nut together with the sediment clinging to its inner surface. If the nut cannot be removed by hand, strike cap 33 by hand to move it down and start the nut with a special wrench or a screwdriver inserted in one of its slots. The cap must not be held with any type of tool between the lower portion of the rotor and the filter body. The layer of deposits inside the cap may be 15 to 20 mm thick. After removing cap, remove screen 35, clean and wash the cap and screen in kerosene.

After cleaning, screen 35 is put in place and then, trying not to damage the rubber sealing ring 32 of the rotor, cap 33 is carefully put back and nut 37 is hand tightened. The cap should rest in its place without any tilt. Then, check to see whether the filter rotates easily by hand, install cover 38, tighten wing nut 39 and replace the crankcase ventilation filter.

After cleaning the centrifuge, start the engine and see whether oil leaks from beneath the filter cover. After the engine is stopped, the rotor should continue to spin for 2 to 3 minutes, which can be checked by its characteristic sound.

At alternate TO-2 cycles (depending on operating conditions of the truck, each 11,000 or 17,000 km) when the centrifuge is being cleaned, remove nut 41, remove rotor 53 from its shaft, clean it to remove deposits, wash it in kerosene, blow through the aperture of the jets with compressed air and carefully return it to its position. The rotor must be removed carefully, since the upper circle of the thrust ball bearing 48 may stick to it. This circle must be held to be sure it does not fall into the crankcase. The cap and rotor are usually cleaned of deposits with blades made of hard types of wood or plastic.

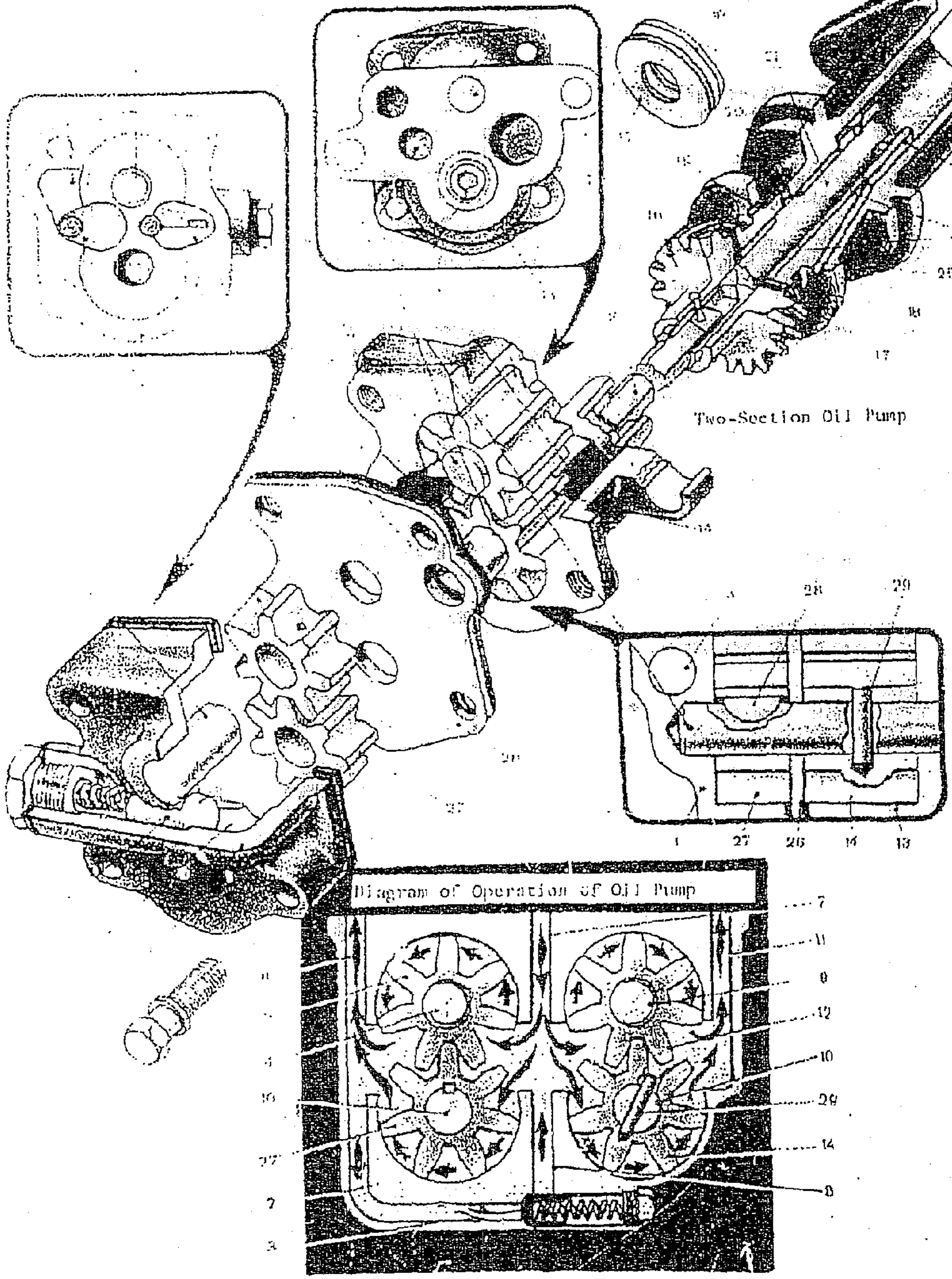
The durability of the engine depends to a great extent on the operation of the centrifugal oil filter.

Filling of the engine with dirty oil and poor cleaning of oil will cause early wear of the friction surfaces, particularly on the crankshaft. With centrifugal oil filtration, the oil usually becomes darker in color during engine operation. The reason for this is the presence of carbon particles, which have no influence on the wear of the engine, and which are not trapped by the centrifugal filter. Thus, if the oil has been changed at the proper intervals and the rotor of the filter spins at the normal speed, the color of the oil should not be cause for alarm. If the thickness of the sediment on the inside of the cap is greater than 15 to 20 mm, the interval between oil changes should be reduced to 1,000-1,500 km. It must be recalled that the quality of cleaning of the oil is reduced as the thickness of the deposits increases.

Since the effectiveness of cleaning of the oil depends to a great extent on the speed of the rotor, it is necessary to be quite careful in dissembly the filter. Nothing should be done which might cause dents on cap 33 or curvature of shaft 45 of the rotor, since this type of damage unbalances the rotating parts.

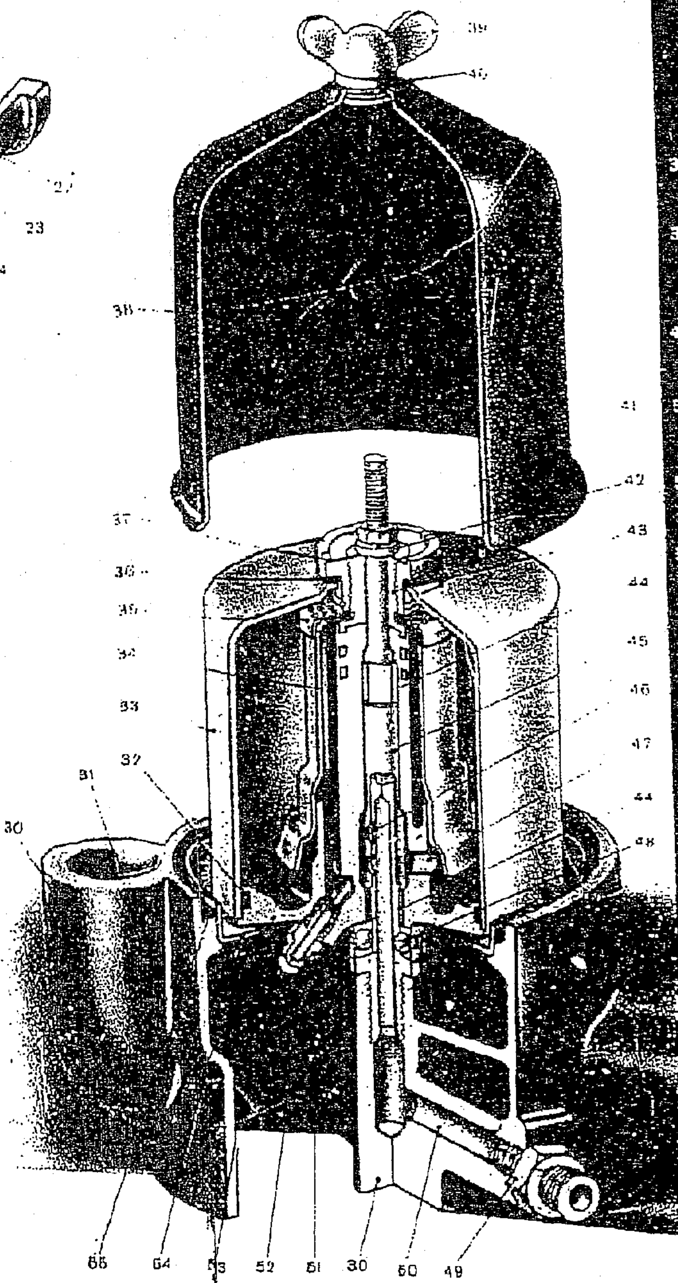
If the jets are removed (to replace or clean them), they must be returned to their position so that the marks on the rotors are opposite the angle of the six-sided jet body, with the jet apertures directed opposite to the direction of rotation of the rotor. Otherwise, the rotor will not spin at the proper speed.

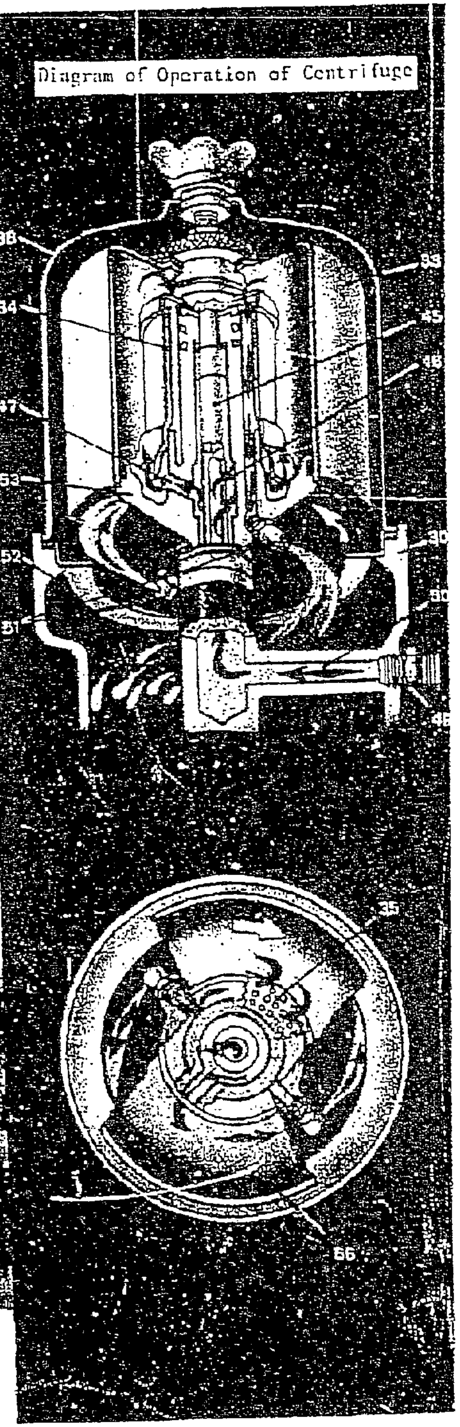
1 - body of lower section of oil pump
2 - channel feeding oil to reducing valve
3 - reducing valve of lower section of oil pump
4 - lower section driven gear shaft
5 - lower section driven gear (7 teeth)
6 - channel feeding oil from lower section of pump
7 - channel feeding oil to pump
8 - bypass channel
9 - upper section driven gear shaft
10 - oil pump drive shaft
11 - channel feeding oil from upper section
12 - upper section driven gear (7 teeth)
13 - body of upper section of oil pump
14 - upper section driving gear (7 teeth)
15 - oil pump drive intermediate shaft
16 - gear driving distributor and oil pump (15 teeth)
17 - bronze thrust disk
18 - steel thrust disk
19 - channel lubricating drive gear
20 - aperture for lubrication of bushings in body
21 - drive shaft of distributor
22 - distributor and oil pump drive body
23 - drive guide bushing
24 - copper-zinc alloy body bushings
25 - channel for lubrication of cam shaft gear
26 - barrier between sections
27 - lower section driving gear (7 teeth)
28 - key
29 - pin
30 - intake manifold
31 - aperture for installation of oil pipe
32 - rubber sealing ring of rotor
33 - rotor cap
34 - rotor guide cup
35 - steel filter screen
36 - fiber gasket for nut
37 - cap nut
38 - centrifuge cover
39 - cover wing nut
40 - cover wing nut washer
41 - rotor fastening nut
42 - thrust disk
43 - rotor tip
44 - bronze bushing of rotor
45 - hollow shaft of rotor
46 - aperture feeding oil to internal cavity of rotor
47 - channel feeding oil to centrifuge cap
48 - rotor thrust bearing
49 - centrifuge inlet nipple
50 - channel feeding oil to centrifuge
51 - rotor jet
52 - channel for drainage of clean oil into crankcase
53 - centrifuge rubber
54 - reflector
55 - rubber gasket of cover
56 - layer of precipitated contaminants



Two-Section Oil Pump

Centrifugal Oil Filter -- Centrifuge





Lubrication Diagram of Engine

As the engine operates, oil from crankcase 9 is sucked up by sections 60 and 55 of the oil pump through the nonmoving oil pickup 57 with its screen filter. Each of the two sections of the oil pump operates independently of the other and pumps oil into one of the main lines.

From the lower (supplementary) section 60, the oil goes only to the filter. From channel 61 of the delivery cavity of the pump, it passes through channel 8 into the block and line 15 to the centrifugal filter.

From the upper (main) section 55 of the pump, the oil is sent through channel 53 into the main oil channel 43, in the right bank of the block, from which it is fed under pressure to lubricate the parts of the engine, to the compressor and oil radiator. The oil moves through channels 42 to the main bearings 44 of the crankshaft and bushings 46 of the cam shaft. The oil moves from the main bearing journals through channels 52 in the crankshaft to centrifugal traps 18 in the big-end journals, and from them through channel 17 to lubricate big-end bearings 49.

The big-end journals and bushings have a special drilled aperture for drainage of oil, while the connecting rods contain an aperture 1.5 mm in diameter in the upper portion of the big-end. Once each time the crankshaft rotates, at the moment when the drilled aperture in the big-end journal mates with the aperture in the connecting rod, a stream of oil is forced through this aperture under pressure, lubricating the face of cylinder liner 40 and the cams.

The oil removed from the cylinder liner by the oil scraper ring passes through the drilled aperture in the channel for the ring into piston 41, where it passes through channel 63 to the small end of the connecting rod, the drilled aperture in the connecting rod bushing, the clearances between the edges of the piston and wrist pin 64. After lubricating the wrist pin, this oil runs down into crankcase 9.

The first journal of cam shaft 48 has radial and longitudinal holes drilled. The oil passes through them to lubricate the spacer ring of the cam shaft gear.

Oil passes from the second and fourth bushings of cam shaft 48 through channels to the corresponding shaft journals (the fourth journal also has a diametrically drilled aperture) to vertical channels 10 of the block, after which, filling space 7 between the lug and head, it rises to horizontal channel 6 in each of the heads. From the horizontal channels, the oil moves through vertical circular channel 4, formed by the clearance on the inside of the rocker arm shaft upright (the front upright in the right bank and the rear upright in the left bank) between the fastening lug and the upright into oil channel 3, within the rocker arm shaft 2. From this channel, the oil passes through radial drilled holes into the rocker arm shafts under pressure to lubricate the bushings of the rocker arms, then through channels in the short arm of rocker arm 1 and its adjusting screw to lubricate the upper tip of lifter rod 39. The lower tip of rod 39 operates in an oil bath formed in the internal cavity of the tappet. The excess oil flowing from the apertures in the tappet lubricates the lifter guide, the working end of the tappet and the cam.

The excess oil accumulating in the cylinder heads beneath the valve cover flows down into crankcase 9 through special channels 38.

The valve stems in their guides and the parts of the gas distributing mechanism are lubricated by the oil fog formed in the crankcase by expulsion of excess oil from the big-end bearings and spraying of oil by the rotating parts of the crankshaft and connecting rod mechanism.

Oil flows from the fifth bushing 46 of the cam shaft in the cylinder block into cavity 70 between the rear end of the cam shaft and the block plug. From this cavity, the oil is delivered under pressure to lubricate the bushings of shaft 66 through aperture 71. In order to avoid excess pressure in cavity 70, the oil from it flows through drilled hole 72 to gear 73 and lubricates it. The excess oil from the upper cavity, beneath the distributor, is drained through channel 67 to driving gear 45 of the cam shaft, lubricating this gear.

Gears 20 of the cam shaft 48 are abundantly lubricated by clean oil flowing down from the centrifugal filter into the cavity behind the distributor gear cover, then into crankcase 9.

Oil for lubricating of friction parts of the compressor travels under pressure from the main oil pump 43 through tube 24 to the rear cover of the compressor casing, passes through the channel in the seal and is sent through the channels of crankshaft 27 of the compressor to the big-end bearings. The main ball bearings of the crankshaft, compressor cylinder liner and wrist pin are lubricated with oil sprayed as it flows from the clearances between the big-end of the connecting rod and the big-end bearing journals. The oil from compressor case 26 travels through tube 25 to engine crankcase 9.

The oil flowing from the centrifugal filter, from the cam shaft, distributor gears and cam shaft bearing and crankshaft main bearing journals, as well as the oil sprayed from the big-end bearings onto the internal walls of the block, enters the crankcase and is collected by oil pickup 57 and returned to the lubricating system. A portion of the oil in the upper section of the oil pump is once more pumped into the main oil channel 43 and follows the path described above, while the remainder is pumped through the lower section of the pump through channel 8 to the centrifugal filter.

When operating at high speed, and also when the engine is started cold with thick oil, the pressure in the main oil channel 43 and lower section of the oil pump 60 increases sharply.

In order to avoid excessive oil pressure, the lubricating system has two plunger-type reduction valves, which are used to bypass oil from the main lines when necessary. Valve 58 in the lower section of the oil pump is installed directly in the pump, while valve 21 for the upper section is installed in the main oil line 43 on block 47 on the right side of the motor, below the fuel pump. Both valves are of identical design.

Reduction valve 21 consists of a cylindrical plunger, a spiral spring, bushing and rubber plug. The oil pressure acts on the end of the plunger. The plunger can move, overcoming the resistance of the spring. As the pressure increases to 3.6 kg/cm^2, the plunger, as it moves, begins to open the drain channel aperture, through which the oil is bypassed. As the rotating speed of the engine increases, the oil pressure increases. This results in further opening of the drain aperture, so that a greater quantity of oil is bypassed from the main line, partially leaking into the cavity behind the plunger (containing the spring). In order to avoid interference with the operation of the plunger, the oil is carried away through a special drain aperture. Full opening of the drain channel aperture valve occurs at a pressure of 4.5 kg/cm^2. The reduction valves are adjusted at the plant; they need not be adjusted during operation.

The installation of reduction valve 21 at the end of main oil line 43 facilitates more rapid approach of the oil to the main and big-end bearings as well as the cylinder liners, when the engine is first started, particularly cold. Thus, the wear of cylinder liners, piston rings, pistons and bearings is greatly reduced. However, it must be recalled that the engine cannot be operated at high rpm's when cold, since cold oil has high viscosity and cannot lubricate the friction surfaces rapidly and in sufficient quantities. When

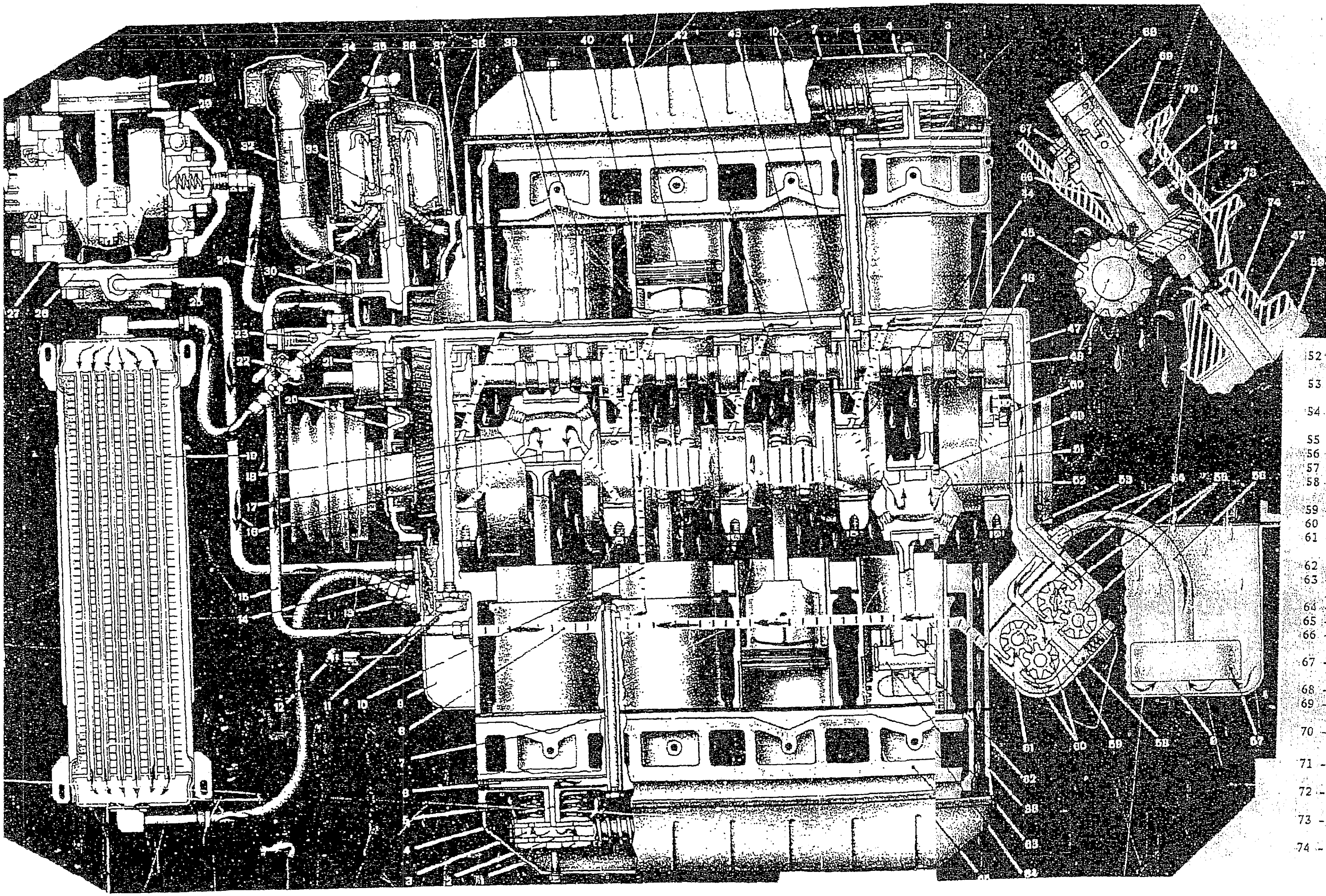
the engine is started and until it has warmed up to 80-90°, which is determined from the cooling fluid temperature gauge, the truck should not be driven rapidly. The sensor of this indicator is carried in the intake manifold.

A drop of lubricating system pressure to less than 0.8 kg/cm^2 at moderate crankshaft rotation speeds (1,000-1,200 rpm) or to less than 0.3 kg/cm^2 at idle speeds will make it impossible for the oil to reach the friction surfaces in quantities sufficient for reliable lubrication of parts.

The most frequent reason for a drop in oil pressure in the lubrication system is a failure of reduction valve 21 in the upper section of the oil pump (clogging, breakage or weakening of the spring). When this happens, the plunger remains open and the oil bypasses, regardless of the pressure in the oil lines.

Other reasons for losses of oil pressure include insufficient level of oil in the crankcase; overheating of the engine, causing the oil to become too thin; use of low-viscosity oil; leakage of oil through oil channel plugs; excessive wear of crankshaft bearing bushings, cam shaft bearings or oil pump parts. In some cases, oil pressure may drop because of breakage of oil lines.

1 - rocker arm
2 - rocker arm shaft
3 - oil channel in rocker arm shaft
4 - circular oil channel in rocker arm shaft upright
5 - valve spring
6 - channel feeding oil to rocker arm shafts
7 - space for oil feed to rocker arms
8 - channel feeding oil to centrifuge
9 - crankcase
10 - vertical channel feeding oil to rocker arms
11 - oil pressure warning light sensor
12 - oil pressure warning light
13 - oil drain tube from oil radiator
14 - chamber draining oil from centrifuge to crankcase
15 - tube feeding oil to centrifuge
16 - channel feeding oil to oil pressure sensor
17 - channel feeding oil to big-end bearing
18 - centrifugal oil cleaning trap
19 - oil radiator
20 - cam shaft drive gears
21 - reduction valve of main oil line
22 - oil radiator valve
23 - oil radiator safety valve
24 - tube feeding oil to compressor
25 - tube draining oil from compressor
26 - compressor crankcase
27 - compressor crankshaft
28 - compressor piston
29 - compressor connecting rod
30 - channel draining clean oil from centrifuge
31 - centrifuge rotor sprayer
32 - oil filler pipe
33 - centrifuge rotor hollow shaft
34 - crankcase ventilation filter
35 - rotor cap
36 - centrifuge cover
37 - intake manifold
38 - channel draining excess oil from block
39 - valve lifters
40 - cylinder liner
41 - piston
42 - channel feeding oil to main bearing of crankshaft
43 - main oil channel
44 - main bearing of crankshaft
45 - cam shaft drive gear
46 - cam shaft journal bushing
47 - block
48 - cam shaft
49 - big-end bearing
50 - channel feeding oil to rear cam shaft bushing and to rear main bearing
51 - crankcase



52 - channel feeding oil to big-end journal
53 - channel feeding oil to main oil line
54 - channel for delivery of oil to sections of pump
55 - upper section of oil pump
56 - oil collecting tube
57 - oil collector body
58 - reduction valve of lower section of oil pump
59 - oil pump body
60 - lower section of oil pump
61 - channel feeding oil from lower section of pump
62 - connecting rod
63 - channel feeding oil to little-end bushing and wrist pin
64 - wrist pin
65 - cylinder head
66 - shaft driving distributor and oil pump
67 - channel for lubrication of cam shaft gears
68 - distributor
69 - distributor and oil pump drive body
70 - cavity receiving oil from fifth cam shaft bushing
71 - aperture feeding oil to body bushings
72 - channel for lubrication of drive gear
73 - gear driving distributor and oil pump
74 - oil pump drive shaft

55

55-a

Ventilation of Crankcase

The gases from cylinders 30, penetrating between the cylinder liner and piston 31 with piston rings into crankcase 1 of the motor, contain water, acids, products of thermal decomposition of heavy fuel fractions, carbon, compounds of lead, scale and wear products. The sulfur and anti-knock additives in the fuel form sulfuric, hydrochloric, hydrobromic, carbonic, nitric and other acids, which are highly corrosive. This causes corrosion of engine parts, contamination and oxidation of the oil. The hot exhaust gases reaching the crankcase contact the oil sprayed up during operation of the engine, increasing oxidation processes. Fine precipitates and products increasing the corrosive action of the oil are deposited in the crankcase. Sediment accumulation increases as water enters the oil, and also if the engine operates cold, a result of frequent stopping and low engine loads, when the temperature of the cooling fluid in the engine falls below 40-50°. If the engine operates hot, the lubricant on the cylinder walls and other parts, as well as in the crankcase, is burned and thinned, and the supply of lubricant is reduced. Gases diffuse into the metal, changing its structure, greatly increasing wear of parts. Corrosive wear of cylinders is increased at high temperatures, due to the formation of nitric, formic and acetic acids in the cylinders. The gases reaching the crankcase increase the pressure in the crankcase, causing leakage of oil through glands and joints, and oil is also carried away from the crankcase together with the gases leaving it.

The engine of the GAZ-66 truck uses an open ventilation system. As the truck is driven at high speeds, a rarefaction is set up in crankcase breather pipe 27, which is transmitted to area 26, formed by intake manifold 22, barrier 28 and the internal walls of block 25 in the spaces between cylinders 30. The rarefaction is transmitted to crankcase 1 through windows 23 in cylinder block barrier 28 and further to section 12, chamber 16 and oil filler pipe 20. The air penetrating through the radiator is then drawn in through body 18 of the crankcase ventilation filter, passes through its capron filter element 19, where it is cleaned of dust, then travels down oil filler pipe 20, through chamber 16 and section 12 into crankcase 1. The delivery of air to body 18 of the crankcase ventilation filter is increased by the cooling system fan which directs the air stream through the radiator cover to the engine by means of its blades 14.

The fresh, clean air entering the crankcase of the engine, traps the gases and vapors penetrating into the crankcase from the cylinders, as well as the products formed as a result of oxidation of oil, and carries them away into the atmosphere through crankcase vent windows 23, section 26 and vent pipe 27. The gases which penetrate beneath the valve covers 38 are drawn away by the air stream through channels 41.

The drops of oil sprayed into the crankcase and picked up by the air stream are held back by baffle 28 in the block and oil reflector 25 of body 24 of the crankcase vent pipe system.

The ventilation system operates effectively when the truck is driven rapidly at high engine speeds; when it is driven at low speeds (below 35 km/hr) and particularly at the idle, or if vent pipe 27 is plugged or its channel is covered with deposits, the effectiveness of the operation of the crankcase ventilation system is greatly reduced. This increases the gas pressure within the crankcase 1, and the gas begins to leak into the atmosphere through oil filler pipe 20 and body 18. There are oil reflectors in tube 20, in order to reduce the consumption of oil carried away by the gases. Ineffective operation of the ventilation system causes deposits to be formed on the internal surface of body 18, sludge deposits are formed in the crankcase, and engine parts are corroded. Furthermore, resin formation is increased and the increased penetration of gases, heating and

great oxidation of the thin layers of oil on the parts cause the formation of varnish deposits. The effectiveness of the ventilation system is also decreased when the engine operates cold.

Maintenance of engine lubrication system. The oil level in the engine must be checked daily, and at least every 300-500 km. If oil consumption increases, the level must be checked more frequently. If the level of oil in the crankcase drops, fresh oil is poured in through oil filler pipe 20, using the same type as is in the engine. Mixing of different types of oil is not permitted.

Only phenol selective cleaning types of oil which meet standard GOST 10541-63 can be used for lubrication of the engine. The main type for carburetor-type motor vehicle engines is AS-8 (M8B), although AS-10 (M10B) can be used during the summer.

Industrial oil type 50 (SU machine oil), and oils meeting GOST1862-57, earlier recommended for lubrication of multicylinder carburetor engines, are absolutely forbidden for this engine.

The basic characteristics of oils used for lubrication of the engine are presented in the table below.

The complex additives introduced to the oil greatly improve the antioxidant, cleaning and anticorrosion properties of the oil. Wear of the main parts of the engine (cylinder liners 30, piston rings 31, main bearing bushings 70 and big-end bearing bushings 32) is greatly reduced by the use of types AS-8 and AS-10 oil. These oils have good cleaning properties and chemical stability, forming the minimum quantity of varnish deposits and slight resin and scale deposits after long-term operation.

The oil should be changed in the engine at every other TO-1. The best conditions for operation of the oil in the engine are provided by conservative driving, with the engine warm, with the engine under full load, when the ventilation system is in good condition and wear of engine parts is moderate.

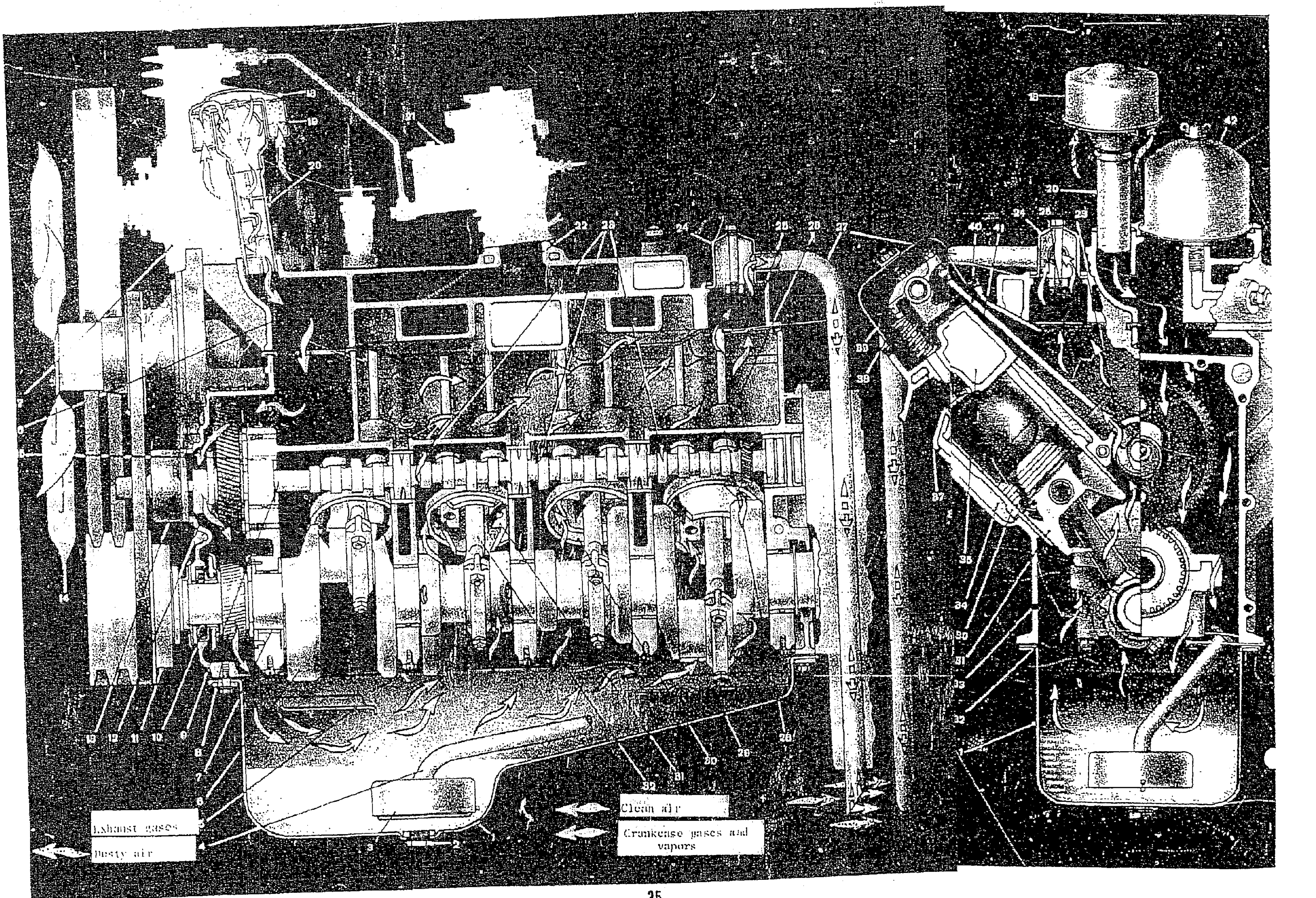
When operated under very dusty conditions (summer on dusty roads and in deserts) or at low temperatures with frequent stopping of the engine and operation at idle (winter use in the city), or when engine parts are highly worn, the oil must be more frequently changed. The oil should be changed with the engine warm, by draining the oil from crankcase 1 through its drain aperture, closed by drain plug 2, installed with a red copper gasket. The oil must also be drained from the body of the oil filter, the oil radiator and the compressor. After draining the oil, the entire system should be flushed to remove resin deposits, contamination products and water. If the oil is changed without washing out the crankcase, the deposits which have accumulated in the crankcase, oil pump receiver, oil lines and oil radiator will remain in the lubrication system and immediately contaminate the fresh oil. This is undesirable. To wash out the lubricating system of the engine without dissembling it, a washing fluid should be used, consisting of type 2 spindle oil or type 3 spindle oil. After the washing fluid is poured into the engine, it is started and allowed to operate several minutes or, without starting the engine, the sparkplugs are removed, the crankshaft is rotated for 1 to 2 minutes and the washing fluid is drained from the crankcase. The lubricating system of the engine must not be washed with kerosene, since this removes the oil film from the parts and the kerosene-softened deposits on the walls and parts will clog the lubricating system.

After the wash liquid is drained, the engine is filled with fresh oil and started for a few minutes to refill the lubricating system with oil. After the engine is stopped, the oil is then added up to the normal level.

If the lubrication system is quite dirty, and also when the engine is being prepared for winter operation, it is recommended that crankcase 1 be removed and carefully washed with kerosene. At the same time, the oil pickup screen, oil radiator, oil feed and drain tubes are washed.

Indicators	Oil Type According to GOST 10541-63			
	AS-8 (M8B)			AS-10 (M10B)
	with additives			
	VNII NP-360	DF-1	SB-3 and DF-11	VNII NP-360
Kinematic viscosity, cst:				
-- at 100°C	8 ± 0.5	8 ± 0.5	8 ± 0.5	10 ± 0.5
-- at 0°C	1,200	1,200	1,200	2,000
Detergent properties according to PZV, units, not over	1	1	0.5	1
Sulfur content in oil without additives, %	1	1	1	1
Flash point, °C, at least	200	200	200	200
Pour point, °C, not under	-25	-25	-25	-15
Density at 20°C, g/cm^3, not over	0.895	0.895	0.895	0.9

1 - crankcase of engine
2 - oil drain plug
3 - oil pickup body
4 - oil collector pipe
5 - forward horizontal crankcase baffle
6 - crankshaft
7 - main bearing bushing
8 - crankshaft gear
9 - cam shaft
10 - crankshaft front seal
11 - crankshaft pulley
12 - section for drainage of filtered oil and delivery of fresh air to crankcase
13 - governor sensor
14 - cooling system fan
15 - cam shaft bearing journal bushing
16 - chamber for drainage of oil to crankcase
17 - compressor
18 - body of crankcase ventilating filter
19 - capron filter element
20 - oil filter pipe with oil reflector
21 - carburetor
22 - intake manifold
23 - ventilating points in cylinder block baffle
24 - crankcase vent pipe body
25 - oil reflector
26 - section for exhaust gas passage
27 - crankcase vent pipe
28 - block baffle
29 - rear horizontal baffle
30 - cylinder liner
31 - piston and ring
32 - connecting rod
33 - block
34 - block water jacket
35 - head water jacket
36 - intake valve
37 - cylinder head
38 - valve cover
39 - rocker arm
40 - valve lifter
41 - channel in block for passage of valve lifters and exhaustion of gases from beneath valve cover
42 - centrifuge (centrifugal oil filter)


Exhaust gases
Dusty air
Clean air
Crankcase gases and vapors

59-a

Cooling System of the Engine

Basic Data

Cooling system -- liquid, closed, with forced circulation of liquid by centrifugal water pump.
Liquid used: summer -- fresh, soft water; winter -- antifreeze liquid with low freezing point.
Cooling system capacity -- 23 l.
Radiator -- tube-plate type. Cooling surface of radiator 12.02 m^2.
Radiator blind -- plate valve type. Mechanical drive by lever from cabin.
Radiator cap -- sealed, with vapor and air valves.
Thermostat -- liquid, single-valve type.
Fan -- six-bladed, asymmetrical balanced, with bent blades.
Fan and water pump drive -- V-belt, driven by crankshaft pulley.

Cooling system structure. The cooling system consists of water jackets 57, 64 and 46 in the block, heads and intake manifold, the water pump, radiator with blind 18 installed before it, fan 28 with shroud 27, thermostat, safety valves 70 and 73 and drain valves. The cooling system also includes the cabin heater and engine start heater. The thermal mode of the engine is maintained constant by means of the thermostat, fan, tubular radiator and blind.

When the engine is operating, impeller 34 of the water pump draws cooling fluid from radiator bottom tank 9 and pumps it through two channels 44 into the right and left cylinder block water jackets. The cylinders are cooled by forced circulation of fluid by the water pump, assuring even cooling of the entire surface of the cylinders and minimum warping.

The fluid from jackets 57 of block 2 passes through apertures into the connected passages and spaces and into water jacket 64 of the heads to cool the combustion chambers.

From the head jackets, the liquid enters water jacket 46 of intake manifold 48.

From the right head, it passes through the right longitudinal passage to return tube 40. From the left head, the fluid passes through the left longitudinal and central passages, washing the channels in the intake manifold through which the fuel-air mixture is transmitted from the carburetor to the combustion chambers. Thus, the fluid heats the fuel-air mixture, then enters the right longitudinal passage, from which it also travels to return tube 40.

The heated liquid from the return tube may circulate, depending on the temperature of the engine, through one of two paths.

a) when the motor is warm, when thermostat valve 37 is open, through tube 29 to radiator tube 26, from the radiator through delivery hose 4 to water jacket 57 of the engine along the path described above, completing the large circle;

b) when the engine is cold, when valve 37 of the thermostat is closed, bypassing the radiator, through bypass hose 35 to the intake cavity of the water pump, then to the water jacket of the engine, completing the small circle.

Thus, the thermostat can disconnect the radiator from the cooling fluid circulation path. This greatly speeds up warming of the engine during starting when the fluid circulates through the small circle.

In order to check the cooling fluid temperature in the cooling system, temperature sender 47 is included in the intake line, and is connected to a thermometer on the dashboard. Also, the upper tank of the radiator contains sender 21 of the overheat warning lamp. When the temperature of the cooling fluid reaches 104-109°, the "water" warning light on the dashboard lights up green. When this occurs, the blind should be opened, or if it is already opened, the truck must be immediately stopped and the reason for the overheating eliminated (add water, increase fan belt tension, etc.).

The fluid from the cooling system is drained through four valves simultaneously: valve 6 on the lower radiator tank, valve 61 on the start heater tank, the drain valve on the right side of the block and the valve on the cabin heater hose. Since the system is sealed, radiator cap 22 must be removed in order to allow rapid drainage.

Since the drainage valves may be plugged up with sediment which is formed in the cooling system or ice (in winter), the valve should be opened up with wire if necessary.

Design of cooling system devices. The liquid type thermostat is placed in a special cavity in intake manifold 48. At the top is return tube 40, which is fastened to the intake manifold by two lugs. Valve 37 of the thermostat operates automatically with changing length of cylinder 41, containing a volatile liquid. The bottom end of the cylinder is fastened to a bracket on body 36 of the thermostat. In the upper portion of the cylinder there is a shaft, to which valve 37 is attached.

As the temperature of the cooling fluid increases, the pressure inside the cylinder 41 increases and the cylinder becomes longer. Valve 37, rising, allows the cooling fluid to pass through the return tube into the radiator. The valve begins to open when the cooling fluid reaches a temperature of 78°, and opens fully at 91°. As cylinder 41 cools, the valve moves downward once more and enters its seat. The cooling fluid then bypasses the radiator and returns to the intake cavity of the water pump, from which it circulates through the water jacket until it is heated to a temperature of 80-90°.

In order to remove air from the water jacket of the engine and prevent the formation of air bubbles as the cooling system is filled, and also for partial circulation of the fluid through the radiator even with the engine cold, the valve of the thermostat has a small circular hole or notch. It is necessary to check for cleanliness of the hole, since if it is plugged up it is generally impossible to fill the cooling system completely.

The radiator consists of upper brass tank 24 and lower brass tank 9, connected with three rows of flat brass tubes 26, 43 tubes per row. The tubes are connected by soldered corrugated copper cooling plates 14. The great external surface of the plates assures effective heat transfer from the radiator tubes. The upper tank carries brass throat 23 with radiator cap 22, which seals the entire cooling system tightly.

The cap is equipped with two safety valves: steam (exhaust) valve 73 and air (intake) valve 70. Steam valve 73 protects the radiator from damage which might occur in case of overheating of the cooling fluid and the resulting increase in pressure in the system. It opens if the excess pressure rises

to 0.45-0.55 kg/cm^2. The water in the radiator boils at about 109° at this pressure. When the steam valve opens, the steam is exhausted through steel steam pipe 20. Thus, the steam valve assures operation of the cooling system without boiling and loss of water at high temperatures. Air valve 70 opens when the fluid in the system is cooled.

In order to protect the radiator tanks and tubes from being crushed by atmospheric pressure, this valve allows air to enter the system when the rarefaction in the system reaches 0.01-0.10 kg/cm^2.

Normal operation of the valves depends primarily on the condition of the gaskets. Therefore, the condition of the gaskets should be carefully observed. If the valves do not operate properly, the system will not be sealed and the consumption of water due to evaporation will increase sharply. In some cases, damage to radiator cap valves may cause deformation of the tanks and tubes of the radiator.

Lower tank 9 of the radiator carries a flange with drain valve 6 and a fitting connected to delivery hose 4. The lower tank includes reinforcement member 11 which is fastened by means of bolts through two brackets 10 to rubber supports 8 and brackets 7 of the frame. The bottom of the tank is protected from excessive cooling and from dirt by splash barrier 17. The radiator mounting parts also include adjustment arms connected on both sides to the side uprights of frame 15 of the radiator blind, connecting its upper and lower tanks. These arms can be used to change the slope of the radiator.

In order to create a concentrated air flow to cool the tubes and plates of the radiator, shroud 27 with a circular space for the blades of fan 28 is fastened to the rear of the radiator.

Six-bladed steel fan 28 is used to pull air through the radiator core. In order to reduce vibration and noise, the fan blades are placed unevenly around the circumference, and their ends are bent to improve the distribution of air flow over the motor. During manufacture, the blades are tested in a special device for the proper bend and shape. The fan is statically balanced, and therefore must be replaced as a unit.

The fan, water pump and generator are driven by crankshaft pulley 12 by means of fan belt 13. The belt tension is adjusted by rotating the generator. When a pressure of 4 kg is applied to belt 13 at the midpoint (between the generator and fan pulleys), it should deflect by 10-15 mm. The belt must not be skewed. If the belt becomes loose, it may slip, overheat or separate into layers. The engine will then overheat, and the generator will fail to charge the battery normally. Furthermore, the generator pulley will be heated, which may cause coking of the lubricant and failure of the generator shaft bearing on the drive end. Excessive tightening of the belt causes belt breakage, as well as excessive wear of the water pump and generator bearings.

Radiator blind 18 is used for manual adjustment of the cooling of the radiator. It consists of 16 galvanized steel plates, placed horizontally and hinged to frame 15. The blind flaps are controlled by a lever fastened to the floor of the cabin of the truck. When the lever is pushed downward, the flaps open, i.e., they are parallel to each other and the air passes freely through to the radiator. When the lever is moved upward, the plates are rotated around their horizontal axes and prevent free passage of air to the radiator. When the lever is pulled fully upward, the blind flaps are fully closed.

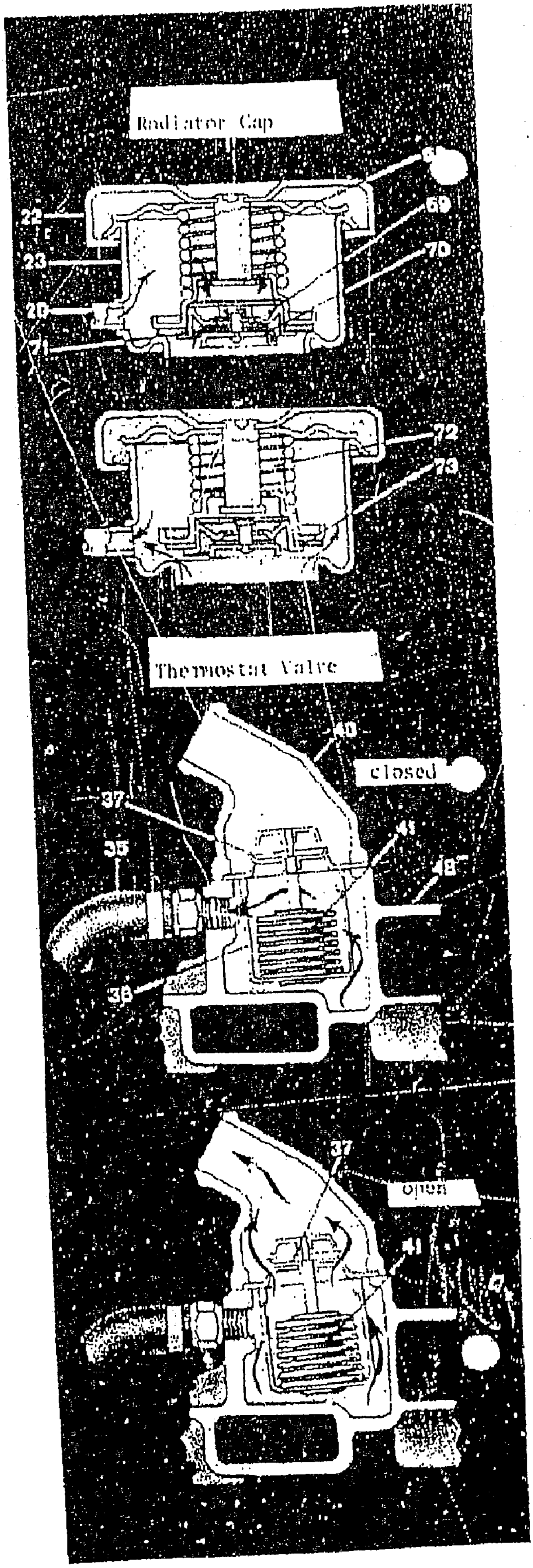
The lever can be held at anyone of nine positions by its stop, depending on the surrounding air temperature and engine operating mode.

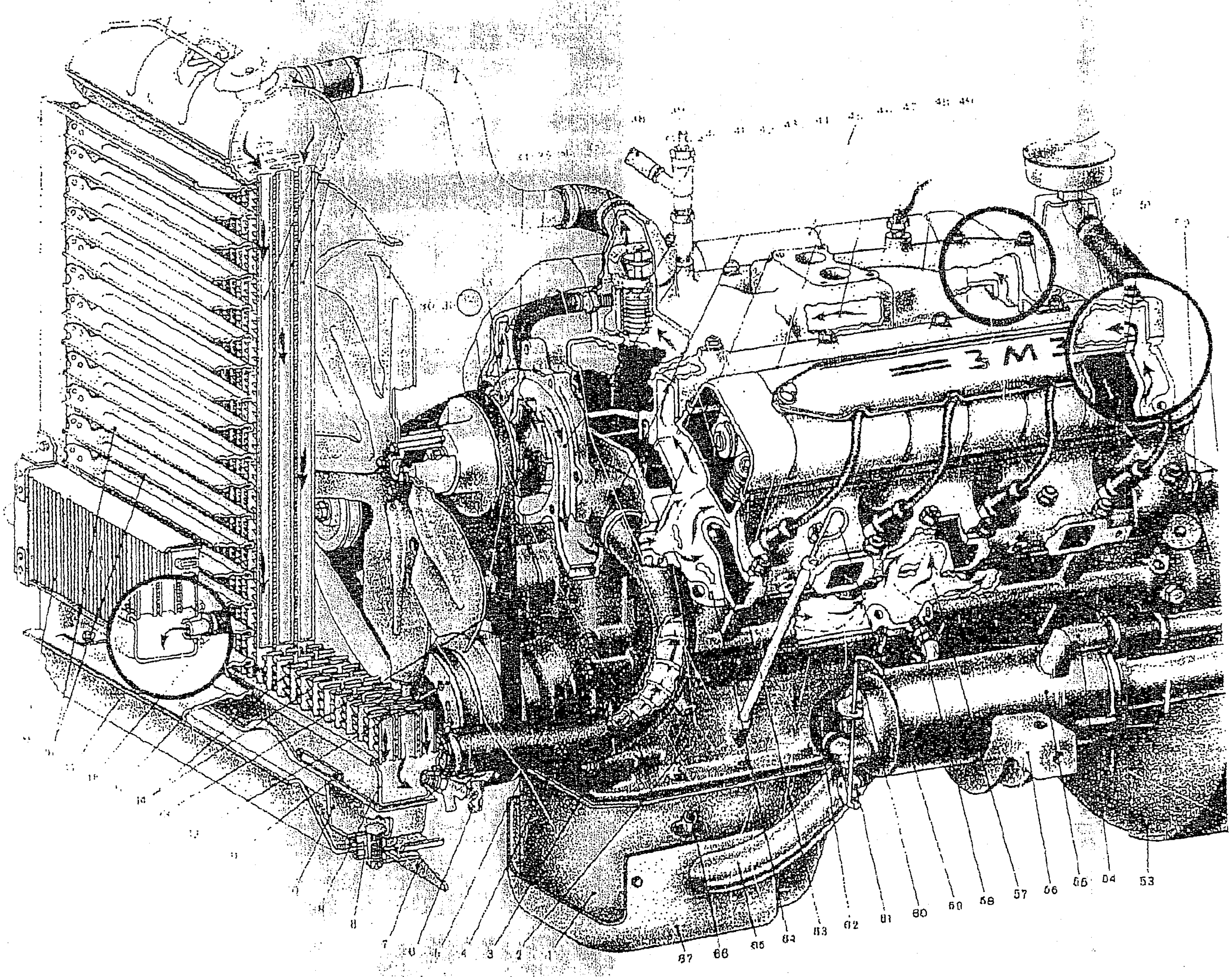
To allow more rapid warmup of the engine, it should be started with the radiator blind closed. In order to avoid lengthening engine warmup time, the flap on the right wall of the cabin should be left closed and the cabin heater fan turned off. The cooling fluid in the engine should be kept at a temperature of 80-90°.

Only clean, soft water with a minimum content of mineral impurities should be used in the engine. The water should be changed as seldom as possible, since frequent changing increases corrosion and the formation of scale. The system should be filled in winter using a fluid with a low freezing point (antifreeze).

Care of the cooling system consists of daily checking of the cooling fluid level in the radiator before beginning operation, drainage of water if the truck is to be parked for a long time in the winter, checking and elimination of fluid leaks through joints, testing of the radiator cap valves, testing and adjustment of fan belt tension, regular lubrication of water pump bearings, checking of the thermostat, flushing of the cooling system and lubrication of the radiator blind lever.

1 - crankcase
2 - block
3 - hose shaper spring (frame)
4 - radiator delivery hose
5 - distributor gear cover
6 - drain plug
7 - radiator mounting bracket
8 - rubber cushions on radiator mount
9 - lower radiator tank
10 - radiator tank bracket
11 - lower plate (reinforcement) of radiator
12 - crankshaft pulley
13 - fan, water pump and generator belt
14 - cooling plates
15 - blind frame
16 - cabin heater return hose
17 - forward splash guard
18 - radiator blind
19 - oil radiator
20 - steam pipe
21 - water temperature warning light sender
22 - radiator cap
23 - radiator throat
24 - upper radiator tank
25 - radiator return hose
26 - radiator tubes
27 - fan shroud
28 - fan
29 - radiator return fitting
30 - fan spacer wheel
31 - fan belt pulley
32 - water pump bearing oiling device
33 - water pump cover
34 - water pump vein
35 - bypass hose
36 - thermostat body
37 - thermostat valve
38 - hose delivering fluid to heater
39 - heater shut off valve
40 - water jacket intake fitting
41 - thermostat cylinder
42 - water pump body
43 - channel feeding cooling fluid from pump
44 - channel (2 used) feeding cooling fluid to block
45 - valve cover
46 - intake manifold water jacket
47 - cooling fluid temperature sender
48 - intake manifold
49 - starter heater filling funnel
50 - hose for pouring water into starting heater
51 - head
52 - nipple on tube supplying hot fluid to block jacket
53 - transmission and flywheel casing cover
54 - tube delivering hot fluid from heater
55 - starter heater tank
56 - starter heater tank mounting bracket
57 - block water jacket
58 - nipple supplying fluid to heater
59 - oil level indicator
60 - drain valve control lever
61 - starter heater drain valve
62 - hose supplying fluid to heater
63 - exhaust gas channel
64 - head water jacket
65 - exhaust pipe of heater
66 - oil radiator drain tube fitting
67 - housing directing hot gases beneath crankcase
68 - flat plug spring
69 - air valve seat
70 - air valve
71 - air valve spring
72 - steam valve spring
73 - steam valve


Radiator Cap
22
23
20
71
69
70
72
73
Thermostat Valve
closed
37
35
41
38
37
41
open



Parts of Cooling and Heating System

Water pump. The engine uses a centrifugal type water pump. It is combined with the fan, with which it has a common drive. The pump body consists of two parts, which split in a vertical plane. The first part is body 1, cast of aluminum alloy, one piece with the distributing gear cover. The second part is cover 10, containing the pump, cast of grey cast iron and fastened to the body by lugs. A gasket is placed between the two parts.

Pump shaft 15 turns in two ball bearings 19; the outer, more heavily loaded bearing is larger than the inner, less loaded bearing. Both ends of shaft 15 carry flats. Steel hub 12 of pulley 14 for the water pump and fan is pressed onto the front end, and plastic impeller 21 with radial blades and steel hub is pressed onto the rear end. Hub 12 is fastened with nut 13. The impeller is fastened down by bolt 24, threaded into an aperture in the rear end of the shaft.

The water pump is driven by the fan belt, driven by the crankshaft pulley.

In order to prevent leakage of lubricant from the internal cavity of the body of bearing 19, felt glands are placed on each end.

The working cavity of the pump is sealed with a self-tightening gland. It consists of rubber collar 7, washer 8 (graphitized textolite), spring 4 and two clamps 6 and 5. The gland rotates together with impeller 21, the notches of which mate with the protrusions on textolite washer 8. The washer, pressed by spring 4 against a polished end of the cover of body 10, prevents the cooling fluid from leaking from the working cavity of the pump. Collar 7 prevents leakage of the cooling fluid through the circular clearance between shaft 15 and washer 8. The fluid which may leak from the working cavity through a worn gland enters a channel cut in the shaft, is thrown from the edges of the channel by centrifugal force and runs through test hole 11, 3 mm in diameter, in the cover of the pump body. Thus, flow of fluid from the test aperture indicates a defective gland. When this occurs, the water pump must be removed from the engine, after which bolt 24 which holds down impeller 21 is removed, the impeller is pressed out and the worn parts are replaced. Test hole 11 must not be plugged up, since this will cause the fluid to enter the bearings.

Care of the water pump consists of lubrication of its bearings during each TO-1 with UTV 1-13 lubricant, GOST 1631-61. Solidol should not be used for this purpose, since it decomposes rapidly at high temperatures and loses its lubricating properties. The lubricant reaches the bearings through pressure lubricator 18. Oil is fed in until it begins to flow from test hole 17. The excess lubricant must be removed since it will damage the fan belt. In some cases immediately following lubrication of the bearing, hot oil can penetrate the small ball bearing and its felt gland and appear at test hole 11. This oil must also be removed.

Cabin heater system. The heater is fastened to the front wall of the cabin beneath the dashboard. Its radiator is connected in parallel to the

radiator of the cooling system. The cooling fluid reaches the heater radiator through hose 29 from the water jacket of the intake manifold 50 of the engine through shut off valve 49. The fluid is drained from the heater through return hose 23 to the lower tank of radiator 54. Hose 29 carries drain valve 55, screwed into a special T-connector.

Cold air from outside enters the heater through blind 60 on the right wall of cabin 61. When it is extremely cold, air from the cabin itself can be used for heating. Air is collected through receiving box 59 of the heater.

The air supply is adjusted with special valve 57, set by cable 58 and knob 52. When the knob is pulled upward, the valve is closed and only recirculated air enters the heater. When the knob is pushed downward, the valve is open and outside air is drawn into the heater.

There are two fans in the system for even distribution of heat through the cabin and defrosting of the windshield. One of the fans is located beneath the dashboard (on the heater body), while the other is located on the left (opposite the driver). The fans are driven by ME7-B electric motors, 8 W each. The fans are operated by switches on the dashboard.

Hot air is delivered to fan 45 through special hose 48. The intensity of defrosting of the windshield is adjusted by valves in the bodies of fans 45 and 36. The right valve is moved by lever 33 and cable 56 from knob 53 on the dashboard, the left valve is moved by the knob on lever 46.

When knob 53 is depressed, and the knob of lever 46 is pulled all the way out, the air goes only to defrost the windshield.

When knob 53 is in an intermediate position and lever 46 is in its second fixed position, the air is blown both onto the windshield and into the cabin.

If knob 53 is pulled up, while the knob of lever 46 is placed in its third fixed position, the air goes only to heat the cabin.

The heater operates effectively when the temperature of the fluid in the cooling system reaches 80°. The heater fans should be turned on only 15-20 minutes following full warmup of the engine.

When water is used as a cooling fluid in the winter time, before starting the engine, shut off valve 49 on the intake manifold 50 of the engine should first be closed, then water poured in. This will prevent water from entering the heater radiator and freezing there.

Valve 49 should be opened only after the engine is warm.

In the summer time, when natural ventilation of the cabin is insufficient, forced ventilation can be used. To do this, turn on electric fans 45 and 36 with shut off valve 49 closed and valves 57 in their open positions.

Care of the cabin heating system consists of seasonal maintenance before the beginning of winter operation of the vehicle. This involves flushing the heater radiator, removing and cleaning the valves, testing the condition of the hoses, heater receiver box and the operation of the air inlet flap valve.

The windshield washer is designed to improve cleaning of the windshield by the windshield wipers. It consists of a diaphragm pump with a foot drive pedal, removable water tank 74, capacity 1.5 l, intake hose 65 with valve 75 and a filter, two delivery hoses 66 and 67 and two sprayers 68 and 69, installed before windshield 51. Sprayer jet 70 has a calibrated aperture $0.8^{+0.1}$ mm in diameter. Sprayer ball valve 72 is installed just before the jet.

The diaphragm pump consists of body 64 and cover 63, between which is rubber diaphragm 79. The body contains the three fittings 80 for the hoses.

When panel 76 is pressed down with the foot, diaphragm 79 bends and compressed air is fed through the hoses to intake valve 75 and sprayer 68 and 69. The ball of valve 75 then covers the aperture, preventing the air from leaving while ball valves 72 are opened by the air pressure, and the air is forced out into the atmosphere.

When the driver stops pressing on the pedal, the diaphragm is returned by spring 78 to its initial position, creating a rarefaction in the pump chamber beneath the diaphragm; ball valves 72 of sprayer 68 and 69 are then closed by their springs. At the same time (due to the rarefaction) intake valve 75 is opened, water from tank 74 is pumped through the filter and the intake hose 65 to the pump chamber.

When panel 76 is pressed once more, intake valve 75 closes, the water forced out by diaphragms 79 forces ball valves 72 aside and leaves sprayer jets 70 of sprayers 68 and 69 under pressure, and is sprayed against the windshield. The windshield wiper should be turned on only after the windshield has been washed two to three times.

The direction of the water streams can be adjusted by changing the positions of the sprayers. To do this, loosen mounting screw 71 on sprayer jet 70, rotate the jet to the required new position and retighten the screw.

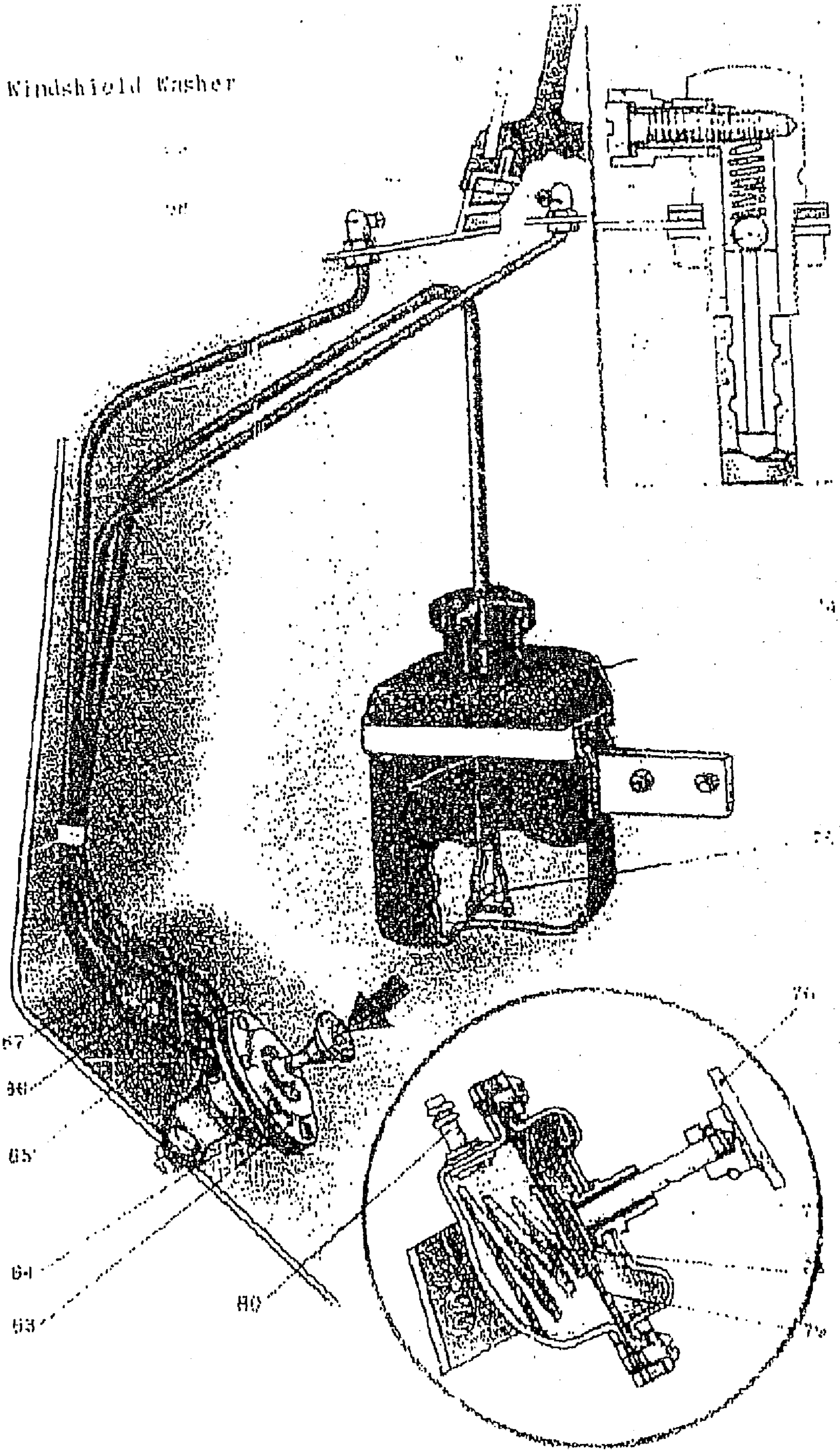
The jet valves and jets must not be allowed to become clogged. If necessary, they should be carefully washed with water and blown out with compressed air. Add filtered water to tank 74 as necessary. The water must be drained from the tank in cold weather.

t,

1 - water pump body
2 - tube for delivery of cooling fluid to water pump body
3 - channel for delivery of cooling fluid to left bank of block
4 - self-tightening gland spring
5 - gland collar clamp
6 - gland clamp
7 - gland collar
8 - graphitized textolite gland sealing ring
9 - channel for delivery of cooling fluid to left bank of block
10 - water pump body cover
11 - test hole for leakage of cooling fluid through gland
12 - drive pulley hub
13 - pulley hub retaining nut
14 - fan and pump drive pulley
15 - fan and pump drive shaft
16 - bearing spacer bushing
17 - test hole for lubricant
18 - pressure lubricator for drive shaft ball bearings
19 - closed shaft bearings
20 - flat for installation of steel impeller hub
21 - impeller (voloknite [fiber material -- Tr.]) of water pump
22 - water pump impeller blade
23 - thread for impeller removing tool
24 - impeller retaining bolt
25 - water pump chamber
26 - hose nipple aperture feeding cooling fluid to pump, bypassing radiator
27 - heater body cover
28 - cabin heater return hose
29 - cabin heater delivery hose
30 - channel carrying cold air into heater body
31 - fitting feeding hot air into cabin
32 - defroster and cabin heater adjustment flap
33 - lever adjusting flaps on passenger side
34 - fitting feeding hot air to windshield
35 - heater fan motor
36 - heater fan
37 - heater body
38 - heater radiator tank
39 - fan rotor impeller
40 - heater radiator tubes
41 - heater radiator tube plates
42 - windshield defroster nozzle
43 - hose for hot air feed
44 - cabin heater fan motor
45 - cabin heater fan
46 - lever operating flaps on drivers side
47 - fitting feeding hot air to drivers side
48 - hot air supply hose
49 - heater shut off valve
50 - engine intake manifold
51 - windshield
52 - air valve knob
53 - fan valve knob
54 - radiator
55 - heater drain valve
56 - cable of heater fan valve
57 - air flow valve
58 - air flow valve cable
59 - box for collection of cold air from cabin for heater
60 - flap delivering outside air to heater
61 - cabin of truck
62 - lever guide slot
63 - windshield washer pump cover
64 - windshield washer pump body
65 - hose feeding water from tank to pump
66 and 67 - hoses for windshield washers
68 - left windshield washer sprayer (drivers side)
69 - right windshield washer sprayer (passenger side)
70 - sprayer jet
71 - jet mounting screw
72 - water sprayer ball valve
73 - jet body
74 - filtered water tank
75 - intake valve with filter
76 - pump pedal
77 - pump shaft
78 - diaphragm spring
79 - sprayer pump diaphragm
80 - water supply tube nipple

42

Windshield Washer



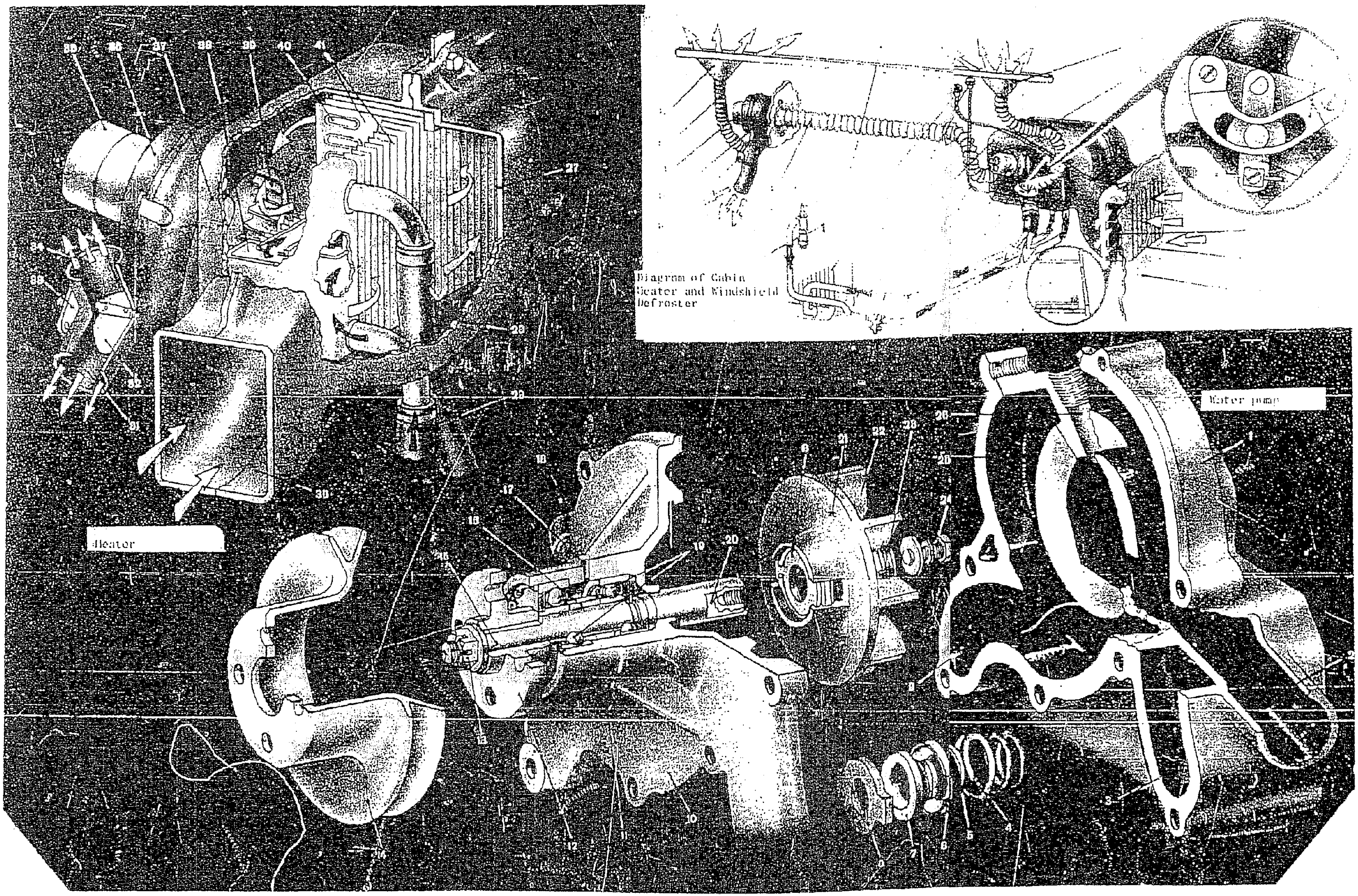


Diagram of Cabin Heater and Windshield Defroster

72

72-a

Basic Data

Starting heater -- gasoline liquid; heats engine cooling system, whether filled with water or antifreeze cooling fluids.
Heater model -- PZhB-12B.
Capacity -- 10,300 kcal/hr
Fuel consumption -- 2 kg/hr
Fuel tank capacity -- ? l

The starting heater is mounted on the engine on the left side. The fuel for the starting heater is fed by gravity flow from gasoline tank 33, fastened to the tool box. The fuel is delivered evenly by an electromagnetic valve. Air is fed into the heater by an electric fan, installed on a bracket fastened to left longitudinal member 1 of the frame. The operation of the starting heater is controlled from a panel mounted in body 44 on the floor of the cabin.

The starting heater is a boiler and consists of four steel cylinders one inside the other. They are the central flame tube and gas flow pipe 5 of heat exchanger 12, consisting of two liquid jackets 3 and 6 which are interconnected. The starting heater is permanently connected to the engine cooling system. The liquid is fed into the heater through fitting 9 from the water jacket of block 14. The heated fluid from the heat exchanger moves through fitting 25, distributing tube 26 and nipples 30 and 32 into the water jackets of the left and right banks of cylinders of the engine.

Tube 26 is connected to filler funnel 28, through which the heat exchanger is filled with water before warming the engine. The funnel is closed with a threaded plug. Test valve 31 is used to check the level of cooling fluid in tube 26.

The fluid is drained through valve 8, which is remotely controlled by a lever 11.

The burner of the heater is mounted on the inside of cover 24, which is fastened by nuts to three lugs welded to the boiler. An asbestos cord sealing gasket is placed in a circular depression in the cover on the same side as the burner. There is an asbestos fabric lining at the point of installation of blade-type vortexers 15. The cover of lining 18 of the burner diffuser 17 and cone 16 are made of heat-resistant alloy steel.

There are two fittings on the outside of cover 24: central fitting 21 which feeds air into the combustion chamber and a side fitting for globe plug 22. The fuel is fed into the combustion chamber through tube 23.

The starting heater operates on gasoline, the same type used for the engine. Fuel tank 33 is a steel tank, welded of two halves. Brass tube 39, fastened to the tank, connects to the atmosphere. The filter of gas line 41 is installed in the base of the tank in fitting 40. It consists of brass body 38 with (52) apertures, 5.3 mm in diameter and brass screen filter 37, made of No 016 screen according to GOST 6613-53.

The fuel is fed from the tank to the combustion chamber of the heater through electromagnetic valve 66 of regulator 59, controlled by the knob 42 of the switch. This same switch operates electric motor 47 of fan 53 to supply air to the starting heater burner.

When knob 42 is set in position II, electric current is transmitted to the motor 47 of the fan and to the winding of coil 65. Armature 63, overcoming the resistance of the spring, is drawn into the coil and the electromagnetic shut off valve 66, mounted on armature 63, leaves seat 62, opening the path of fuel to nipple 58. The air forced by the fan through tube 55 passes through fitting 21 to blade vortexers 20 and further through diffuser 17 of the burner to blade vortexer 15. The air, mixing with the gasoline, forms a flammable mixture, which moves in a spiral stream through the central flame tube and gas lines 5.

Initial ignition of the fuel mixture in the burner is by plug 22, the current for which is transmitted through switch 45 installed on body 44 of the heater control panel. The nominal voltage required for operation of the globe plug is 4 v; it consumes a current of 16-18 a at this voltage. In 30 seconds, the spiral of the plug is heated to a temperature of 800-850°. At the point where the plug enters the combustion chamber, a light alloy steel screen (1 mm thick) 19 protects the plug spiral from cooling by the air flow and fuel spray. After stable combustion is achieved in the chamber, new portions of the fuel-air mixture are ignited by the flame already in the chamber, there is no further need for the globe plug and it should be switched off.

The electrical circuit of the globe plug is connected in series with test spiral 52, which can be seen through cross-shaped port 43 in the upper portion of the control panel. The spiral is made of alloy wire. It is heated when the current is turned on. The operation of the globe plug can be judged from the degree of heating of the test spiral.

During operation of the starting heater, the hot gases formed by combustion of the mixture of gasoline with air pass through the central flame tube and gas pipes 5, then through exhaust fitting 7. These hot gases heat the liquid in the two liquid jackets 3 and 6 of the boiler, and are also used to heat up the crankcase 2 of the engine, for which purpose they are directed beneath the crankcase by cover 10.

The starting heater assures reliable starting of the engine at temperatures down to -40°C in not over 25 minutes.

The fuel feed through seat 62 is adjusted by needle 67 so that combustion occurs without smoke or soot and so that the flame does not extend beyond the end of exhaust fitting 7. The electromagnetic valve is tested for tightness under a vacuum of 1,000-1,100 mm water for 30 sec. Adjustment needle 67 should be backed off by 2-3 turns during this test. The valve should operate precisely with a voltage of 9 v.

When switch knob 42 is put in the "0" position, the voltage across coil 65 disappears and core 63 is returned to its position by the spring, pressing shut off valve 66 against the seat 62, interrupting the gasoline flow. Thus, the electromagnetic shut off valve prevents accumulation of excess gasoline in the combustion chamber and thereby provides fire safety.

When antifreeze is used in the coolant, the engine can be warmed up with the starting heater without leaving the cabin.

The order of operations is as follows:

close the radiator blind;
disconnect the oil radiator;
be sure that there is sufficient fuel supply in tank 33, then open valve 41;

blow air through the heater for 30 to 60 sec by turning on fan motor 47; at this time, knob 42 is set in position I;

using knob 45, turn on the globe plug; when test spiral 52 has been heated to a bright red color, move knob 42 to position II (fan motor on an electromagnetic valve open); in a few seconds, a characteristic fwump should be heard, followed by the rumbling of the flame, indicating that the heater is operating; disconnect the globe plug with knob 45.

If the heater does not begin to operate after 3-5 sec, return knob 42 to the "0" position and repeat the starting operation. If the heater does not start, the switch knob must not be left in position II for more than 10 sec, since the unburned fuel flowing into the boiler may ignite and throw out a large flame.

The heater should be allowed to operate for 15-25 min, depending on the outside air temperature and temperature of the engine.

When the outside air temperature is -30-40°, thickening of the special cooling fluid may result in development of high pressure in the boiler (snapping and cracking will be heard). In this case, the heater must be turned off for 2-3 minutes following each 3-4 minutes of operation.

When the cooling fluid in the cooling system has been heated to 40-50° (according to temperature gauge on dashboard), the crankshaft should be turned over several times with the starting lever to be sure that it turns easily, after which the motor can be started. Then switch knob 42 is returned to position I and valve 41 on the heater fuel tank is closed, to blow out the heater. After the gasoline is used up, which generally requires 50 to 60 seconds (after which the rumble of the flame in the heater will stop), knob 42 is returned to the "0" position.

Warming of the engine when water is used as the cooling fluid is performed in the same sequence, except that first, before the water has been poured into the cooling system, all four drain valves and the shut off valve of the heater on the intake manifold are closed, test valve 31 is opened, and the radiator cap is removed, after which the plug in filler funnel 28 is removed. Air is blown through the heater, then it is started, and after making sure that it is operating steadily, it is turned off. Then 8 or 9 liters of water are poured in through funnel 28, up to the level of test valve 31. As soon as water begins to flow from the valve, it is closed and the plug is returned to the funnel.

The heater and engine are started in the sequence described above. Be careful that the water does not freeze in the supply hose or distributing tube 26 (test by feel). If the water is frozen, it must be thawed by periodically turning on the heater for 1 to 2 minutes at intervals of 2 to 4 minutes and blowing out the heater boiler between heating cycles. After the engine is started, it is warmed up for 1 or 2 minutes at medium speed, then turned off and additional water is added to the cooling system. The additional water is first poured in through filler funnel 28, then (after returning to the cabin and starting the motor) through the radiator filler cap. The water must be poured in slowly, to allow all air to escape from the system.

Only a driver who is thoroughly familiar with the structure of the heater and the rules for its operation can be allowed to use the heater.

It is not permitted to leave the truck during operation of the heater. Uncautious use of the heater, defects in the heater or oil leaks in the

crankcase may cause fires. In order to avoid poisoning with carbon monoxide, the engine must not be warmed up in a closed area with poor ventilation.

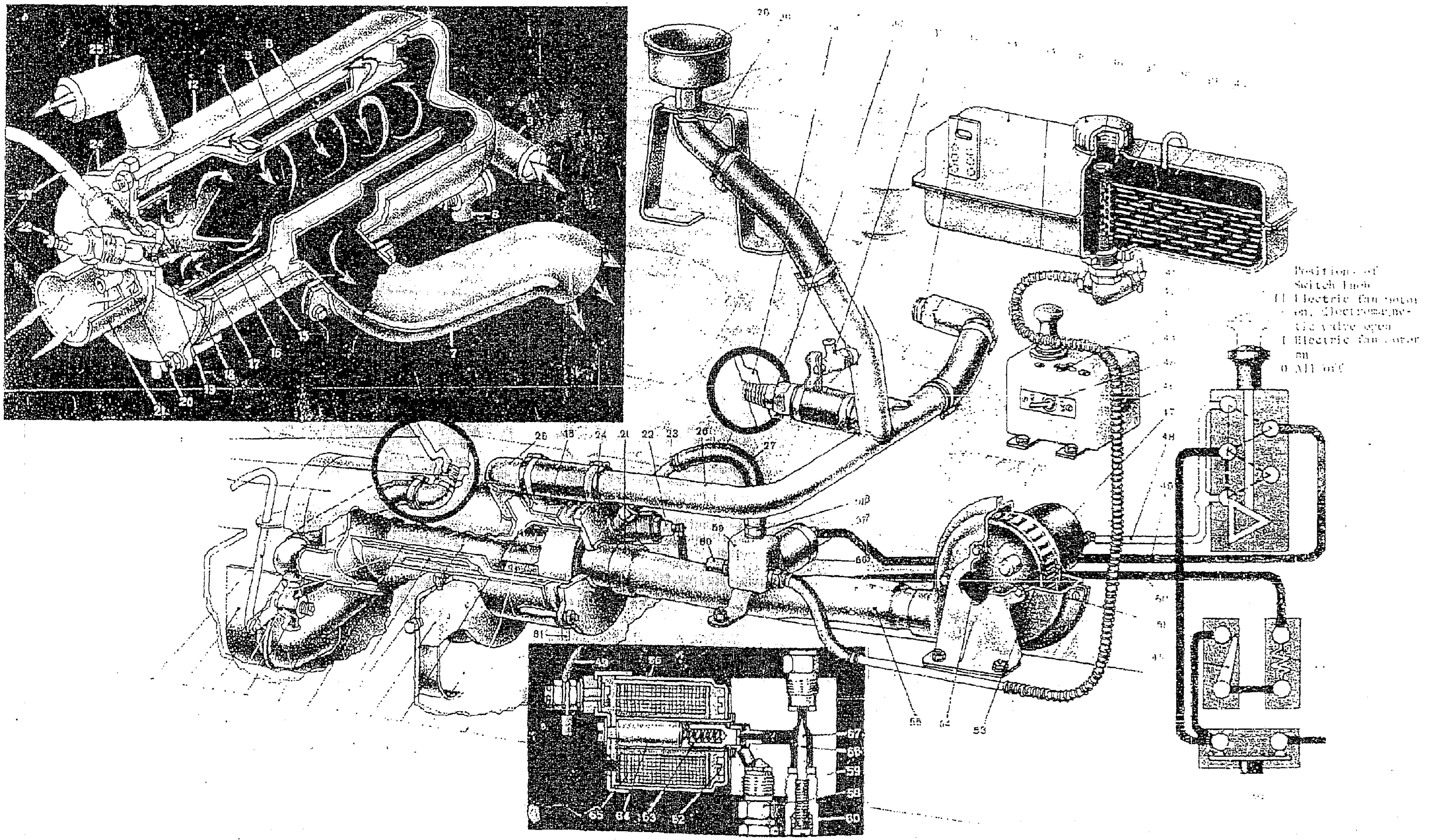
Care of the starting heater consists of seasonal maintenance in the fall. Warm water is poured in through funnel 28 with drain valve 8 open to wash out the heater jacket and lines until clear water flows from the boiler. Tank 33, its filter 37, the fuel hoses and lines are washed with gasoline. The base of the electromagnetic valve, its nipples and adjusting needle are dissembled and washed. The valve core is cleaned of dirt and the globe plug is cleaned of scale.

If the scale deposit is heavy, the starting heater is removed from the engine, dissembled and the scale is removed from accessible areas mechanically, after which it is blown off with compressed air.

During operation of the starting heater, care must be taken to avoid leakage of cooling fluid and fuel at the joints of the lines, hoses and valves.

During the summer, the fuel tank of the starting heater should be left empty.

1 - left longitudinal frame member
2 - bottom of engine crankcase
3 - outer heat exchanger jacket
4 - heater boiler mounting bracket
5 - central flame tube and gas tubes of heat exchanger
6 - internal fluid jacket of heat exchanger
7 - exhuast pipe of heat exchanger
8 - drain valve
9 - fitting feeding liquid from block to heater boiler
10 - cover directing hot gases beneath crankcase
11 - drain valve control lever
12 - starting heater boiler heat exchanger
13 - nipple for supply of fluid from engine to heater
14 - motor block
15 - blade vortexer (8 blades) for flame
16 - burner cone
17 - burner diffuser
18 - burner lining
19 - plug screen
20 - blade air vortexer (6 blades)
21 - air feed fitting to vortexer
22 - globe plug
23 - fuel line feeding gasoline to burner
24 - burner cover
25 - fitting supplying hot fluid from burner to engine cooling system
26 - distributing supply tube
27 - fuel hose feeding gasoline to burner
28 - filler funnel
29 - nipple for filling starter heater with fluid
30 - nipple of pipe feeding hot fluid to jacket in left side of block
31 - starting heater system test valve
32 - nipple on line feeding hot fluid to jacket of right side of block
33 - heater fuel tank
34 - line feeding gasoline to regulator
35 - fuel tank cap
36 - fuel tank filler neck
37 - brass screen filter
38 - brass body of fuel filter
39 - tube connecting fuel tank to atmosphere
40 - fuel filter nipple
41 - gas line valve
42 - electromagnetic valve and heater fan switch
43 - test spiral viewing window
44 - body of starter heater control panel
45 - globe plug switch knob
46 - fuse
47 - starter heater fan motor
48 - line to fan motor
49 - line to electromagnetic valve
50 - line to globe plug
51 - fan body
52 - test spiral
53 - fan rotor
54 - fan air inlet
55 - tube feeding air from fan to burner
56 - body of electromagnetic valve
57 - nipple for gasoline supply to regulator body
58 - nipple for gasoline supply to burner
59 - fuel supply regulator body
60 - adjusting needle seat
61 - heat exchanger drain tube
62 - fuel supply seat
63 - core of electromagnet
64 - valve core spring stop
65 - electromagnetic valve coil
66 - electromagnetic shut off valve
67 - adjusting needle


Positions of
Switch lever
II Electric fan motor
on, electromagne-
tic valve open
I Electric fan motor
on
0 All off

79-

79-a

Fuel System of the Engine

Basic Data

Engine fuel system -- forced type, utilizing type B9-D diaphragm fuel pump.
Number of fuel tanks -- two. Capacity of each tank 105 l.
Fuel tank cap -- sealed, with inlet and exhaust valves.
Fuel filters: settling filter, separates mechanical impurities measuring over 0.5 mm from fuel. Fine purification filter with screen filtering element used to remove smaller particles.

Fuel used. The fuel used for the engine is type A76 motor vehicle gasoline with octane number 76 (GOST 2084-67). Seventy-two octane gasoline can be briefly used. When this is done, the spark advance must be reduced in order to eliminate knock.

Operation with gasoline of over 80 octane is not recommended, since this may cause overheating of the engine, burning of the valves and other problems.

Design of fuel system. The gasoline feed system consists of two fuel tanks 11 and 20, fuel lines, the fuel settling filter with body 28, fine cleaning filter 41 and fuel pump 48.

The fuel tanks are identical in design. Each tank is welded up of two halves -- the upper and lower half -- stamped of lead-plated steel sheet. Two barriers 24 with spertures, dividing the tank into three interconnected sections, are used to increase rigidity and reduce sloshing of the fuel.

The fuel level in the tank is measured by float 13, connected to sender 14, which is connected through switch 34 to electromagnetic fuel level indicator 35, both of which are installed on the dashboard. The indicator operates only when the ignition is on and shows the quantity of gasoline in the tank as a function of the position of the lever of switch 34: when the lever is in the right position, the gauge refers to the right tank; when it is in the left position, it refers to the left tank.

Filler pipe 12 is soldered to the upper half of the tank. It contains removable plug 22 with screen filter 23. To move the pipe to its working position, first pull out plug 22, then rotate it fully clockwise. The top of the tank is connected to the filler throat by an air pipe. As the gasoline is poured in, air flows out of this pipe from the tank.

The throat of the filler pipe is covered by a cap, which creates an air tight seal by means of gaskets 5 and flat spring 2. There are two valves in the gas cap, protecting the tank from excessive pressure or rarefaction. Exhaust valve 3 in the cap opens when the excess pressure in the tank reaches 0.004-0.0165 kg/cm^2, intake valve 4 opens when the rarefaction reaches 0.0045-0.035 kg/cm^2. The valves and cap itself can operate properly only if gasket 5 is in good condition. Check to see that the holes in the inner body of the cap are clean and not covered by the gasket.

All devices connecting the tank to the atmosphere must be installed on the gas tank without breaking the seal. If any of these devices are removed, when they are returned to the tank, measures must be taken to protect the seal by lubricating the threaded portion of the screws and gaskets with shellac or minium.

The gas lines consist of identical steel tubing and flexible hose, made of gasoline-resistant rubber with a cored layer.

Fuel lines 43 and 39, carrying the fuel (under pressure) from the fuel pump to the carburetor, have an external diameter of 8 mm, all others -- 10 mm.

The gasoline from the fuel pump enters the cavity between settling cup 41 and filter element 60. The pressure created by the pump causes the gasoline to move into the filtering element, after which it leaves the filter. Dirt and small mechanical particles settle to the bottom of the settling cup and onto the walls of the filter element, consisting of a metal screen with apertures of 160 × 160 microns, wrapped in two layers. Only clean gasoline goes from the fine filter to the carburetor.

The exhaust system consists of two exhaust manifolds (right and left), two receiving pipes 25 and 27, a muffler and tailpipe 19.

The exhaust manifolds are fastened to the heads through iron-asbestos gaskets by means of lugs and brass nuts.

The muffler is located beneath the floor of the cargo platform on the left. It is a non-dissemblable unit, its body 16 is made of sheet steel in the shape of a cylinder, the internal cavity of which is separated by two vertical barriers 17 into three chambers. Tube 18 with many apertures passes along the axis of the muffler. As they move through this tube, the spent gases pass through the apertures into the chambers and back. The gases expand in this process, reducing their pressure and velocity. This motion of the gases is repeated several times, after which they are exhausted into the atmosphere through tailpipe 19. This equalizes the pulsations of the flow of exhaust gases and decreases the noise at the tailpipe. The muffler also damps sparks and flames. The muffler and tailpipe are connected to the frame of the truck at two points: the muffler is mounted on an elastic steel bracket, the tailpipe -- on a belt with fabric and rubber layers.

<u>Maintenance</u>. The tightness of the connections of the fuel supply devices and fuel lines is checked during daily servicing. The brackets and clamps fastening the fuel lines are tightened during TO-1, and the mounting of the gas caps and operation of the cap valves, operation and cleanliness of screen filter 23 in the movable plug are checked. The fastening of the tanks is tightened if necessary and sediment is removed from them.

During TO-1, after first closing fuel delivery valve 33, plug 29 is removed and the sediment is drained from body 28 of the settling filter. Body 28 is then washed with clean gasoline by opening valve 33 long enough to wash out the settler, then the mounting is tightened.

Dissembly and washing of the settling filter and fine filter are done during TO-2. The condition of the gaskets of the filters must be checked before re-assembly.

During TO-2, the nuts on the flanges of the intake pipes of the muffler and the exhaust manifold mounting nuts are also tightened.

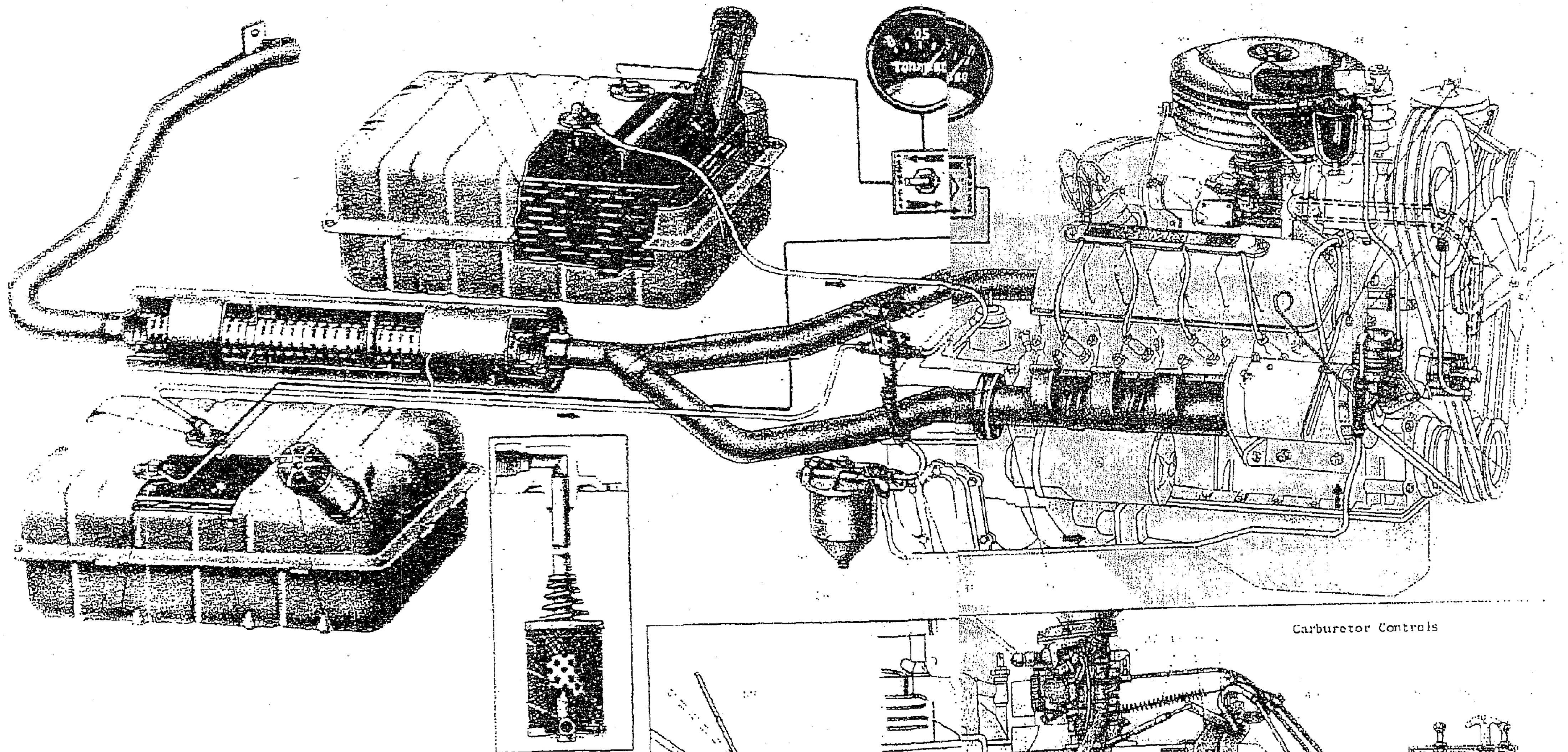
Twice a year (spring and fall) the tanks are cleaned out, the fuel lines washed and blown out.

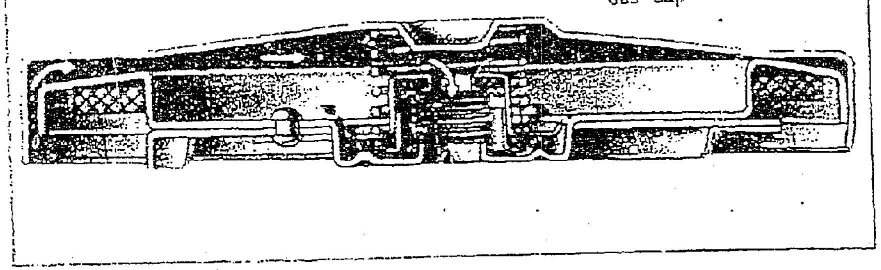
Three-way valve 33 can occupy three positions: handle forward -- right gasoline tank connected to fuel system; handle back -- left gasoline tank connected to system; perpendicular position relative to axis of vehicle -- both gasoline tanks disconnected from fuel system.

When the engine operates, the gasoline from the tank first enters body 28 of the settling fuel filter. This filter is fastened to the right longitudinal frame member beneath the cabin with two bolts. In the settling filter, dirt particles are trapped between the plates of filter element 64, mechanical impurities fall to the bottom of body 28, and the clean gasoline continues on to the fuel pump. The base of the settling filter is cast iron cover 63. This cover has two threaded holes on each side. The holes on the right side carry two nipples: a straight intake and angle output nipple. On the opposite side of the cover, the holes are blocked with threaded plugs. The direction of motion of the gasoline is shown on the cover with the arrows. Filtering element 64 of the settler consists of two uprights and two supporting plates, between which are 170 aluminum or brass working plates, each 0.15 mm thick. Each plate has 12 apertures, through which the clean gasoline passes, and 28 protuberances each 0.05 mm high, forming slits for passage of the gasoline.

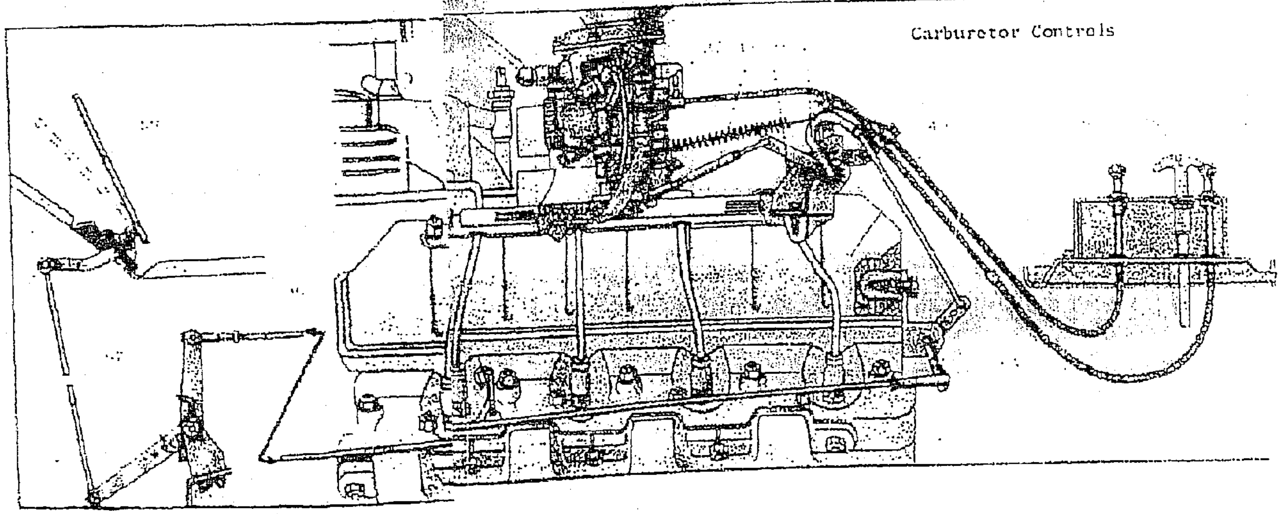
As the gasoline leaves fuel pump 48, before it enters carburetor 37, it passes through the fine filter, fastened to the compressor. This filter consists of body 59, cast of nickel alloy, screen-type filtering element 60, pressed against the body with a spring, and plastic settling cup 41. There is a gasket of oil and gasoline-resistant rubber between the body of the filter and the cup. The settling cup is pressed against the body by means of a special screw and nut 62.

1 - gas cap body
2 - flat spring
3 - exhaust valve
4 - intake valve
5 - gasket
6 - fuel filler pipe
7 - body of filter element
8 - fuel pipe screen filter
9 - filter element spring
10 - receiving tube flange
11 - right fuel tank
12 - fuel tank filler pipe
13 - fuel level float
14 - fuel level sender in tank
15 - fuel tank line
16 - muffler body
17 - barriers in muffler
18 - perforated muffler pipe
19 - muffler exhaust pipe
20 - left fuel tank
21 - fuel drain plug
22 - moving tube
23 - moving tube screen filter
24 - tank barrier
25, 27 - muffler receiving pipe
26 - muffler bottom
28 - settling fuel filter body
29 - sediment drain plug
30 - gas line feeding fuel to fuel pump
31 - gas line feeding fuel to settling filter
32 - right exhaust manifold
33 - three-way valve
34 - fuel level indicator switch
35 - fuel level indicator
36 - governor actuating mechanism
37 - carburetor
38 - air filter
39 - gas line feeding fuel to carburetor
40 - tube feeding air to compressor
41 - settling tank
42 - compressor
43 - gas line feeding fuel to fine filter
44 - arm of manual fuel pump drive
45 - engine
46 - tube for lubrication of governor sender
47 - governor sender
48 - fuel pump
49 - adjusting arm of manual choke
50 - upper shaft lever
51 - upper drive shaft
52 - manual choke lever
53 - radiator blind lever
54 - air valve line lever
55 - lower drive shaft
56 - accelerator adjusting arm
57 - pedal pusher
58 - accelerator pedal
59 - fine filter body
60 - screen filter element
61 - base of filter element
62 - settling filter mounting nut
63 - settling filter cover
64 - plate filter element
65 - settler mounting rod





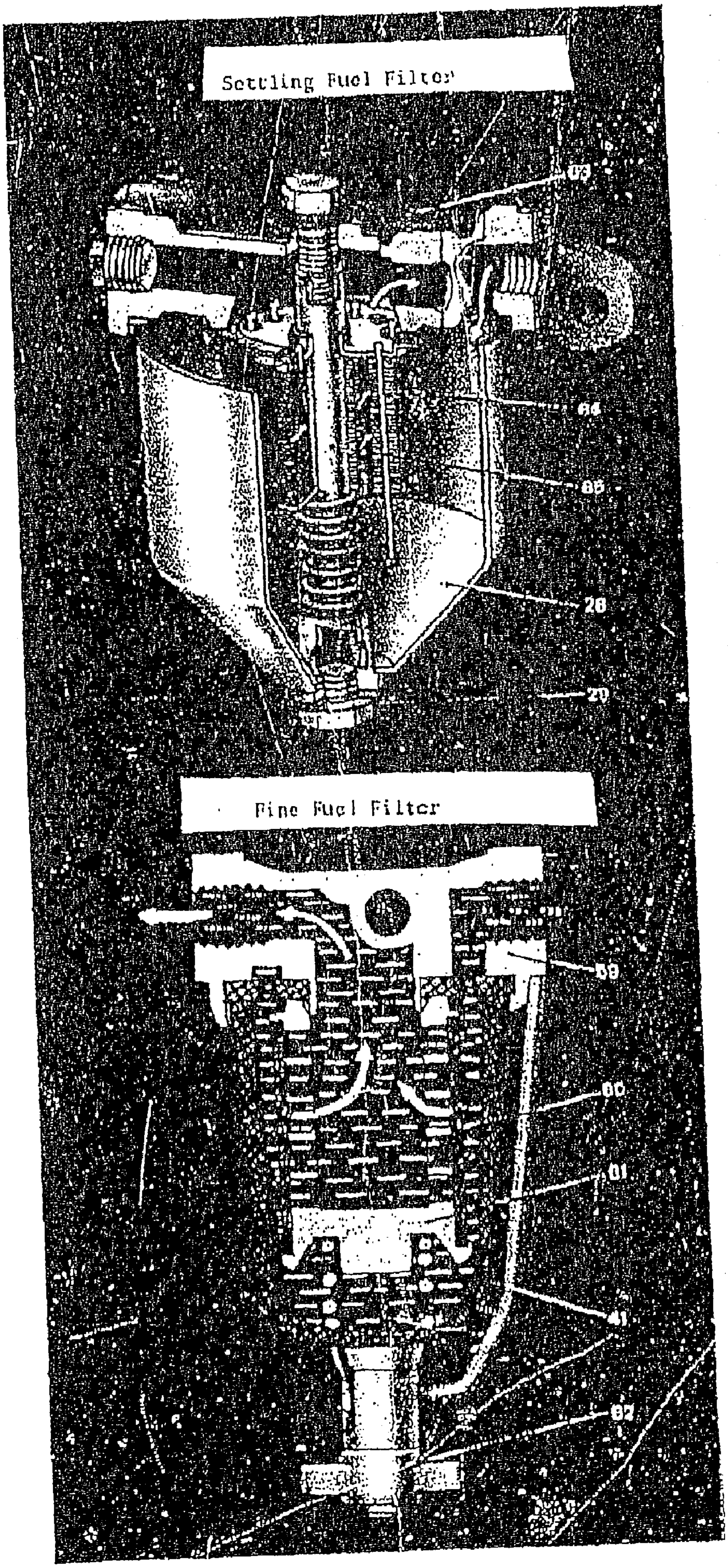
Gas Cap



Carburetor Controls

83-a

83


Settling Fuel Filter
Fine Fuel Filter

Air Filter and Fuel Pump

Air Filter

Basic Data

Filter type -- inertia-oil bath, with two-stage cleaning of air
Filter element -- contact, formed of capron fiber
Oil bath capacity -- 0.55 l

Structure and operation. The air filter is used to remove dust from the air entering the carburetor and compressor. The filter is mounted on a flange of the carburetor air pipe by means of wing nut 2 and bracket 3. Also, the body of the filter is mounted to the intake manifold of the engine by means of special bracket 21.

The air filter consists of two main parts -- cover 20 with filter element 32 of capron fiber and body 1 with oil bath 22. The inside of the upper wall of the cover carries felt gasket 17, designed to reduce the noise of air intake. Rubber sealing gaskets 5 and 8 are placed between the carburetor and the filter, and also between the body of the filter and the filtering element of the cover.

As the engine runs, the air is drawn in through the circular slit between filter body 1 and cover 20 under the influence of the rarefaction developed in the cylinders. As the air moves downward, it makes a sharp turn over oil bath 22, contacting the oil and leaving in it the largest mechanical impurities. The air picks up droplets of oil here and passes through filter element 13; the fine dust particles settle onto the oil-covered capron fiber. Thus, two-stage cleaning of the air is achieved.

After cleaning of the air, it is drawn in through guide tube 6 into the carburetor and through tube 15 into the compressor. The excess oil drains off through element 13 as it is accumulated and carries with it the dust into oil bath 22, thus cleaning the filtering element. The process of self-cleaning of the filter can continue only so long as there is oil in the oil bath.

Maintenance. Care of the air filter consists of its cleaning, washing of the filter element in kerosene and replacement of the oil. This is done at least each TO-1 cycle (3,300-5,100 km). If the truck is used under very dusty conditions, the filter element must be washed and oil changed in the oil bath each day.

The filter may be filled with either fresh or used, but always well settled oil of the same type used for the engine (AS-8, GOST 10541-63).

After washing the filter element, it must be wet in oil and allowed to drain, after which 0.55 l of oil is poured into the bath (up to the mark on body 1) and cover 20 with its filter element is set in place. Over 0.55 l of oil should not be poured into the filter.

If the oil level in bath 22 is above the established level, the excess oil will be carried by the air stream into the combustion chambers of the cylinders.

In dissembling the air filter, be sure that the sealing gaskets are in place between the filter and carburetor, between the cover and body of the filter, and that the washer is in place beneath wing nut 2. Do not forget that if the seals around the air filter are not in good condition, dirty air will enter the carburetor, causing rapid wear of the engine.

Basic Data

Pump type -- sealed diaphragm pump, without settler
Model -- B-9D
Drive -- main drive from cam shaft eccentric, additional drive -- manual
Delivery rate -- 140 l/hr at 3,600 rpm of engine

Design and operation. The fuel pump is used to feed gasoline from the fuel tanks to the carburetor. The pump is fastened to the distributing gear cover on the front right portion of the engine with two bolts and is driven by eccentric 53, a cam disk mounted on the front end of cam shaft 54. The pump is equipped with a manual drive lever 26 with a remote drive arm directed upward.

The fuel pump consists of the following main parts: body 27 with the drive parts, heads 36 with valves, diaphragm 37 and damper cover 42. The body, head and damper cover are cast of a zinc alloy under pressure. The pump contains two cavities -- intake cavity 56 and delivery cavity 55. In the intake cavity, covered with removable screen filter 45, there are two intake valves 52. The delivery cavity contains one delivery valve 38. All three valves are identical in design and consist of collar 41, weak spring 39 (bronze wire) and the actual valve plate, made of gasoline and oil-resistant rubber. The valves are installed in seats in head 36 of the pump, the spring of each of the intake valves is directed downward, of the delivery valve -- upward. When the valves open, the fuel passes through the apertures in the seats. Diaphragm 37 is clamped between body 27 and head 36 of the fuel pump. It is made of varnished fabric, is protected top and bottom by two steel plate disks 35 and connected to pusher 31. The lower plate disk contacts spring 33, which presses the diaphragm to the upper position. Special seal 32, through which pusher 31 passes, is used to prevent penetration of exhaust gases and oil fog into the lower cavity of the pump.

In the body of the pump, shaft 24 carries pump drive rocker 25. The left (short) portion of the rocker is forked. Diaphragm pusher 31 is carried in the fork. In order to soften the impact between the rocker and pusher head 29, textolite washer 30 is mounted on the head. The rocker is constantly pressed against eccentric 53 by return spring 51.

Intake stroke. Rocker 25, rotating under the influence of eccentric 53 of the cam shaft, overcomes the resistance of spring 51 and moves pusher 31 and diaphragm 37 downward. The rarefaction created over the diaphragm causes intake valves 52 to open, and gasoline from the fuel tank is drawn in through nipple 44, filling intake cavity 56 of the pump and the chamber formed over diaphragm 37.

Delivery stroke. When eccentric 53 moves out from under rocker 25, it is rotated by spring 51, the fork end of the rocker rises upward and stops pressing on thrust disk 30.

If the needle valve in the float chamber of the carburetor is opened and, consequently, the resistance over diaphragm 37 is low, spring 33 expands and moves the diaphragm upward, expelling the gasoline located above it through delivery valve 38 and nipple 40 into the carburetor.

If the needle valve is closed, spring 33 cannot overcome the resistance of this valve, and pusher 31 remains in the bottom position. As the cam shaft continues to rotate, rocker 25 rocks idly until the needle valve in the float bowl of the carburetor opens again and pusher 31 moves upward.

be rotated, moving away from rocker 25, so that it can be moved by shaft 28.

As the engine operates, the manual drive lever should be held by its return spring 50 in its extreme downward position. Otherwise, the pump may be cut off, interrupting fuel delivery.

Maintenance. In order to avoid leakage of gasoline between the separation planes of damper cover 42, head 36 and body 27, the fuel pump should never be dissembled unless absolutely necessary. As a rule, defects arising can be eliminated by washing and blowing out. Ordinarily, dissembly of the fuel pump need be performed only in case of damage to diaphragm 37. Leaks through diaphragm 37 are indicated by a sharp drop in delivery of the pump and leakage of gasoline from aperture 34, which is used to connect the lower cavity of the pump with the atmosphere.

To replace diaphragm 37, remove head mounting screws 49, remove head 36 and, removing nut 48, remove upper disk 35, then replace the damaged diaphragm. Be careful in tightening nut 48, to avoid accidentally damaging the fabric of the diaphragm. Metal chips and filings must not be allowed to contact the diaphragm. As head 36 is being installed in place, screws 49 must be tightened with the diaphragm in its extreme lower position, held down by lever 26. This will assure full diaphragm stroke and, consequently, maximum pump delivery. Furthermore, if the diaphragm is not pressed down as these screws are tightened, it may be torn when the pump starts to operate.

The operation of the fuel pump can be checked by measuring the pressure and rarefaction which it creates. At 240 crankshaft rpm, the pump should develop a pressure of 175-225 mm hg.

The rarefaction in this case should be at least 350 mm hg. After the engine is stopped, the pressure and rarefaction should drop slowly, indicating that the valves seal tightly.

Care of the pump consists of washing screen filter 45, valves 38 and 52 and their seats with gasoline, each third TO-2 (16,500-25,500 km), as well as periodic checking of the tension of spring 33. To remove filter 45 from the pump, remove damper cover 42, after loosening two screws 43. To check the tension of spring 33, it is loaded on a special testing device with a test weight of 5.0-5.6 kg; the length of the spring should decrease from 48 mm (in the free state) to 28.5 mm under load. The elasticity of the spring should be such that it provides full delivery of the pump, but does not overcome the pressure of the carburetor needle valve when the fuel level in the float bowl is at the maximum. The mounting of the fuel pump to the engine, connections of the flexible fuel line and fuel line seals and nipples are checked at each TO-2 (5,500-8,500 km).

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1 - air filter body
2 - wing nut
3 - mounting bracket
4 - intake noise muffler
5, 8 - rubber gaskets
6 - throat guide tube
7 - filter body holder
9 - oil feed aperture
10 - inertial reflector
11 - filtering element screen
12 - filtering element body
13 - filtering element
14 - reflecting ring
15 - tube feeding air to compressor
16 - filter element holder
17 - felt cover gasket
18 - filter element body throat
19 - filter cover holder
20 - air filter cover
21 - bracket
22 - oil bath
23 - pump mounting flange
24 - pump drive rocker shaft
25 - pump drive rocker
26 - manual drive lever
27 - pump body
28 - manual drive shaft
29 - diaphragm pusher head
30 - textolite thrust washer
31 - diaphragm pusher
32 - pusher seal
33 - diaphragm spring
34 - screen on aperture connecting to atmosphere
35 - diaphragm plate washers
36 - pump head
37 - fuel pump diaphragm
38 - delivery valve
39 - valve spring
40 - nipple of fuel line feeding fuel to carburetor
41 - valve clamp
42 - pump head damper cover
43 - cover screw
44 - nipple of fuel line feeding fuel to pump
45 - screen filter
46 - intake valve seats
47 - rubber gasket of damper cover
48 - diaphragm mounting nut
49 - screw fastening pump head to body
50 - manual drive lever return spring
51 - pump drive lever return spring
52 - intake valves
53 - pump drive eccentric
54 - cam shaft of engine
55 - delivery cavity of pump
56 - intake cavity of pump

The delivery of gasoline to the carburetor by the fuel pump is automatically regulated by changing the stroke of the diaphragm as a function of the consumption of fuel by the engine. This occurs due to the fact that the diaphragm of the pump receives pressure from both sides -- spring 33 presses upward from below, while the gasoline presses downward from above as its movement is restricted by the needle valve at the entrance to the carburetor. The fuel pump is adjusted so that the pressure of spring 33 cannot overcome the resistance of the needle valve.

As the engine operates at low speeds, the gasoline consumption is not great. The needle of the valve opens only slightly, and the fuel pump operates at less than full stroke length. At this time, rocker 25 moves without load over a portion of its stroke.

As the rotating speed of the engine increases, the gasoline consumption increases, causing an increase in the opening of the needle valve. The resistance to fuel flow during the delivery stroke of the pump decreases, and diaphragm 37 increases the length of its stroke under the influence of spring 33. This continues until the position in the needle is stabilized. With the needle valve fully open, the diaphragm of the fuel pump operates over the full strength length.

The operation of the fuel pump as fuel is pumped manually is similar to that described above, except that rocker 25 of the pump in this case is operated not by the eccentric, but rather by shaft 28 of the manual drive. The arm of lever 26, pulled upward by the handle, overcomes the resistance of return spring 50 and rotates shaft 28, which moves the short end of rocker 25 downward. When the lever 26 is released, return spring 50 expands and rotates shaft 28 of the manual drive back to its initial position.

Thus hand pumping of gasoline into the carburetor is done by successive upward and downward movement of lever 26 by means of the control arm and spring 50.

If eccentric 53 is in a position such that diaphragm 37 is pulled downward by the lever system, the manual pumping mechanism cannot operate. To cure this problem, rotate the crankshaft by one turn. Eccentric 53 will then

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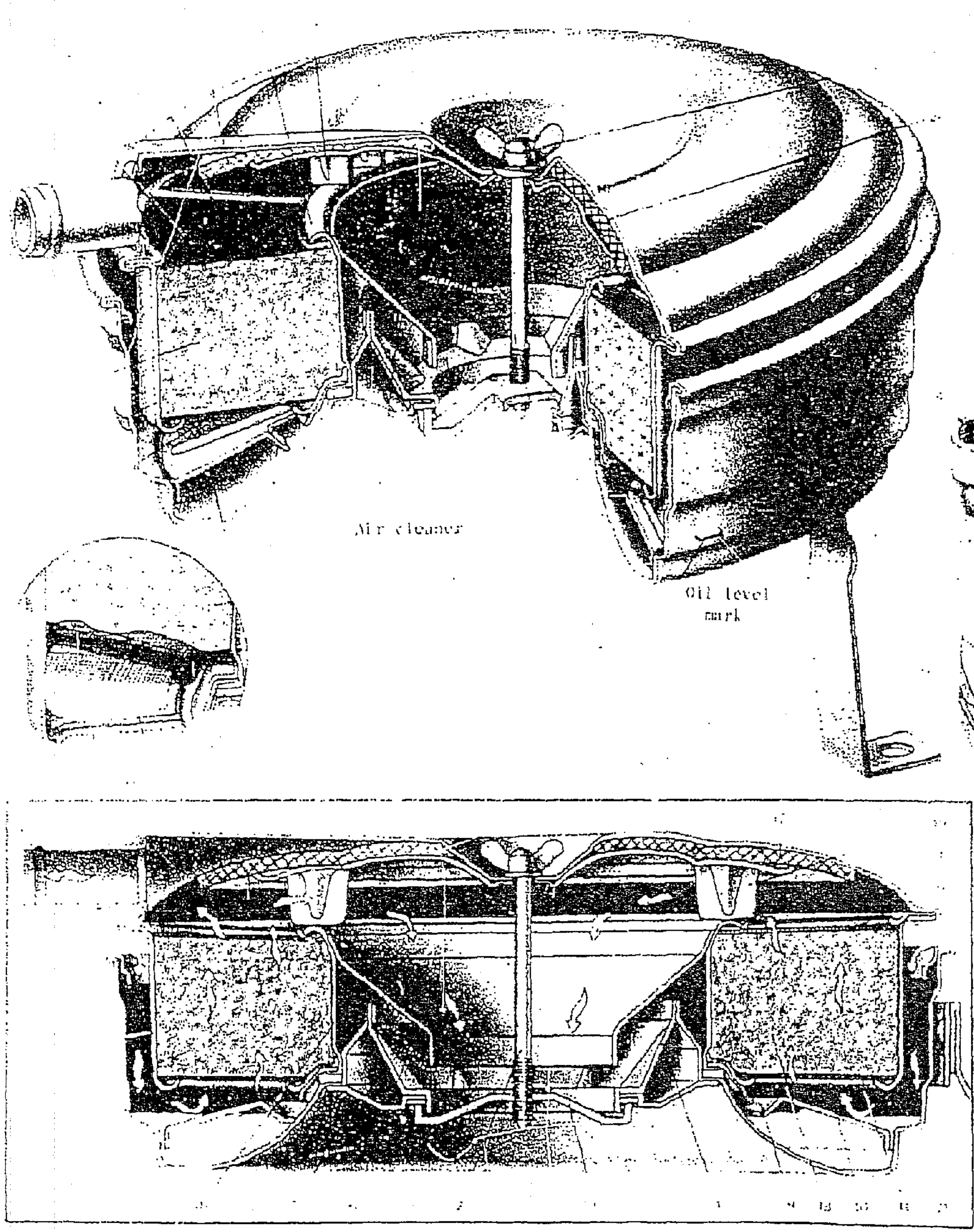
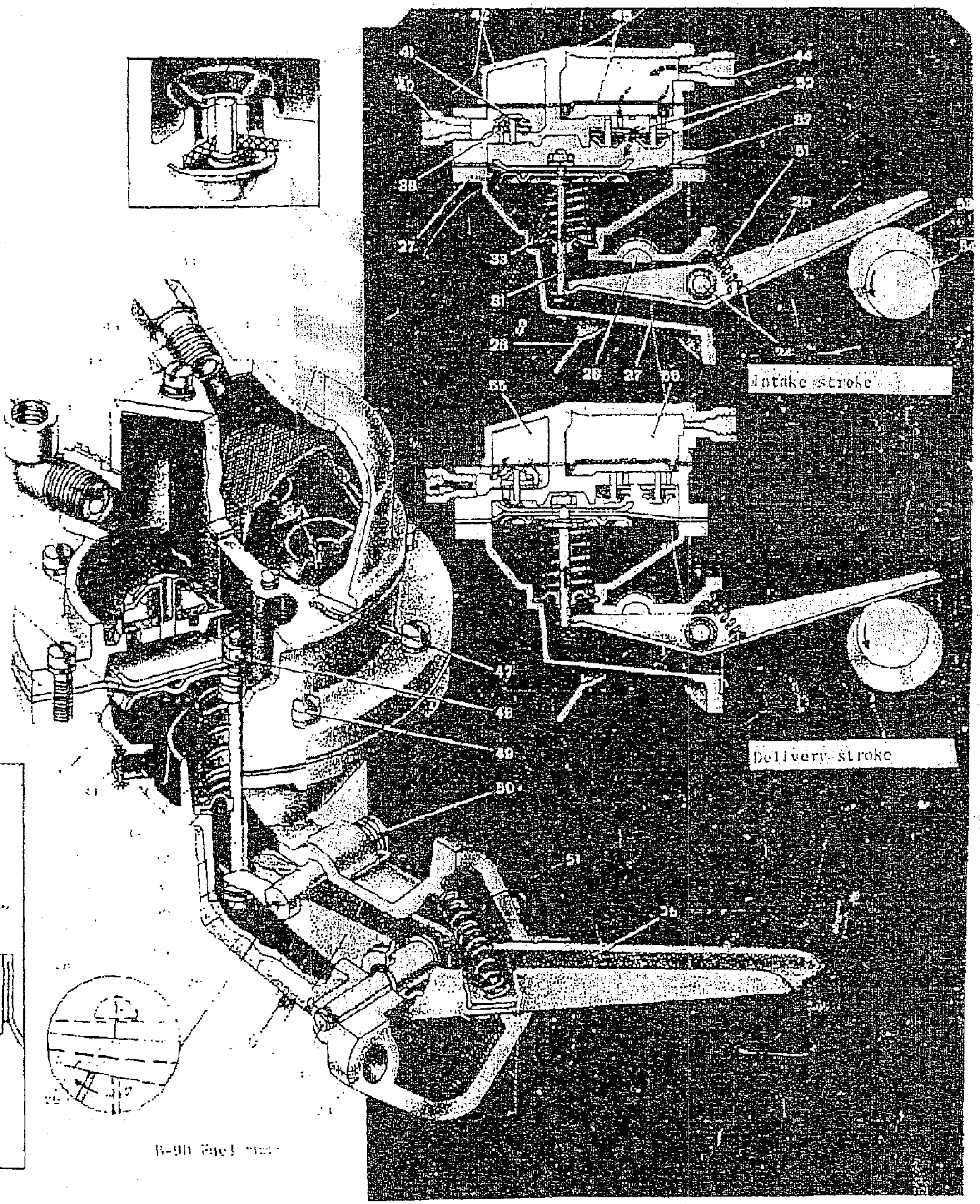


Air cleaner



B-90 Fuel pump

Basic Data

Type of carburetor -- emulsion downdraft, dual throat; each throat has two diffusors and provides mixture for four cylinders of the engine; the main dosing systems operate on the principle of pneumatic braking of the fuel.
Diffuser diameters: large -- 27 mm, small -- 11 mm.
Mixing chamber diameter -- 33 mm.
Jet tube capacities:

- main fuel jet -- 325.5-334.5 cm^3/min;
- idle fuel jet -- 106-114 cm^3/min;
- governor air jet -- 75-81 cm^3/min;
- governor vacuum jet -- 303-317 cm^3/min;

Diameters of jet apertures:

- main air jet -- 0.86-0.80 mm;
- idle air jet -- 1.56-1.50 mm;
- economizer jet (beneath valve) -- 1.66-1.60 mm;
- economizer atomizer jet (in bridge) -- 0.70-0.76 mm;
- accelerator pump atomizer -- 0.66-0.60 mm.

Delivery of accelerator pump -- at least 12 cm^3 per 10 piston strokes.
Float chamber -- balanced.
Gasoline level in float chamber -- 19-21 mm from separation plane.
Mass (weight) of float with lever -- 12.6-14.0 g.
Engine governor -- pneumatic-centifugal type, consists of centrifugal inertial sensor and actuating mechanism with vacuum-diaphragm drive of throttle valves.

Structure and operation (shown on pages 37-41). The emulsion (downdraft), dual throat, type K-126B carburetor installed on the engine mixes the fuel and air in the ratios necessary for effective operation of the engine in various modes.

The carburetor has the following dosing systems and devices: a single balanced fuel chamber, double main dosing system with pneumatic fuel deceleration, dual idle system, mechanical economizer, mechanical accelerator pump, cold engine starting system and actuating mechanism for the engine governor.

The body of the carburetor consists of four parts: body 31 of the float chamber and diffusers, cover 30 and flange 28, pressure cast of zinc alloy, and body 1 of the mixing chambers, cast of grey cast iron. Cardboard gaskets 70 and 79 are installed between bodies 31 and 1, cover 30 and flange 28.

Single float bowl 14 on the carburetor is located in body 31. Cover 30 of the float bowl and its flange 28 carry a balancing channel 22, connecting float bowl 14 to the space over the choke valve 24, eliminating the influence of great rarefaction on fuel feed and enrichment of the mixture (high rarefaction is created in the throat of the carburetor if the air filter is dirty).

The fuel is fed to the float bowl through the fuel line, the nipple of which is installed in threaded aperture 47 in cover 30. It enters through needle valve 72 and filter 46. The screen of the filter is held in place by conical plug 71. Needle valve 72 is turned to its seat in body 48. The diameter of the aperture is 2.2 mm. Reliable seating of the valve in the body (when moving cross country) is provided by its spring, and the valve is pressed tightly into the seat when the float bowl 14 is filled with fuel by single float 52, the lever of which has a tongue 74 resting against the end of valve 72. Float 52 is made of brass, 0.25 mm thick and is suspended on shaft 75, fastened to uprights 73 of cover 30. The movement of the needle valve when the fuel level drops in the float chamber should be at least 2 mm, regulated by bending tongue 74. Inspection window 77, covered with glass 51 and retaining nut 78, is used to check the fuel level in the float bowl.

The fuel level is tested with the engine operating at the idle over a period of 5 minutes, after the truck is parked on a horizontal surface. The fuel level in the float chamber should be constant, between 19 and 21 mm from the upper edge of the side of the float bowl.

Before adjusting the fuel level in the carburetor, it is necessary to test the seal of the needle valve, as well as the tightness of seal and weight of the float. To test the seal of the needle valve, it is placed in a special device which creates a rarefaction beneath the valve; in case the rarefaction decreases, the needle of valve 72 must be turned to fit the seat in the body 48. To check the tightness of the float, it is immersed in water heated to at least 80° and held for at least 30 seconds. If there is a leak, air bubbles will rise from the float. In case of a leak in the float, it is soldered closed. The weight of the float and lever should be between 12.6 and 14 g after re-sealing.

The fuel is drained from the float bowl through the aperture in its bottom, closed with plug 53.

Maintenance of carburetor. During preparation of the truck for driving, be sure there are no fuel leaks, check the operation of the carburetor at idle and at various engine speeds by pressing on the accelerator and releasing it.

After 1,100-1,700 km, during TO-1, tighten the carburetor mounting nuts and check the throttle and choke valve control systems.

After 5,500-8,500 km, during TO-2, after all TO-1 work is completed, test drive the truck 5 to 10 km, checking the operation of the carburetor at the idle and under load.

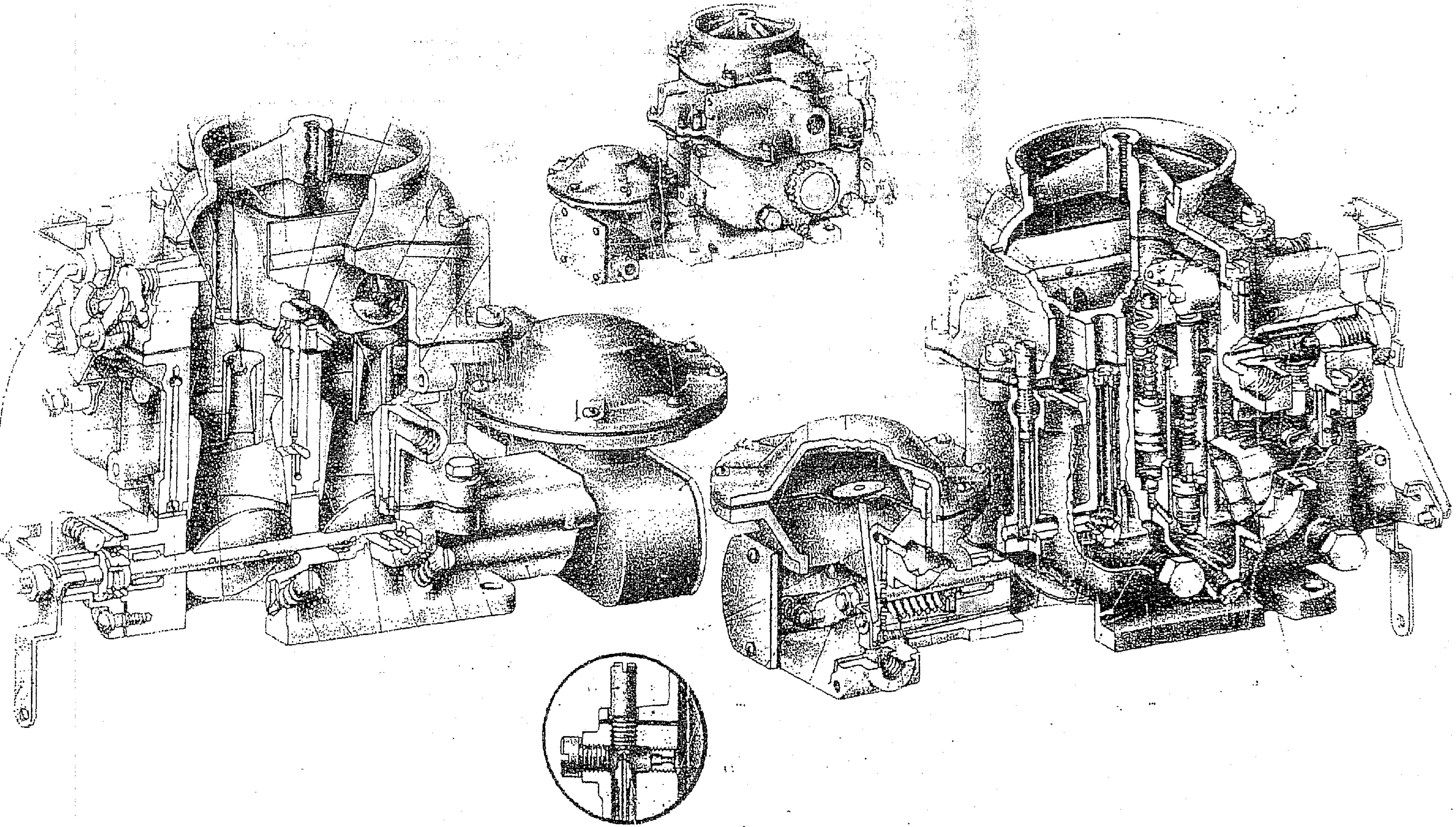
When preparing the carburetor for winter and summer operating seasons (twice per year), it must be cleaned, checked and adjusted. This is done by removing and dissembling the carburetor, cleaning the parts of dirt and washing them in regular gasoline or hot water, heated to at least 80°. A carburetor operated using ethyl gasoline must be carefully washed in kerosene before dissembly. The channels and jets of the carburetor are blown out with compressed air. The condition of the needle valve, float and fuel level in the float bowl are checked. When necessary, the channel is turned, the float is soldered and the fuel level adjusted. The throughput capacity of the jets is tested once each year in the fall. This is done using special calibration devices or calibrated needles. If a jet passes less fuel then normal, it must be cleaned out, or if its throughput capacity is too great, it must be replaced. During assembly of the carburetor, the moment when the economizer valve and accelerator pump begin operation must be properly adjusted, all gaskets must be inspected and the threaded connectors tightened. After assembly, the carburetor is adjusted for operation at the idle.

The correct operation of the carburetor control drive is checked during each TO-1 cycle. The carburetor valves should open and close without sticking. The installation of the pedal is adjusted by changing the length of the cable. With the throttle valves fully open, the pedal should remain at least 4 mm above the floor.

The length of the manual throttle control cable should be adjusted so that there is a clearance of 1 mm between the lever of the upper drive shaft and the stop on the shaft bracket.

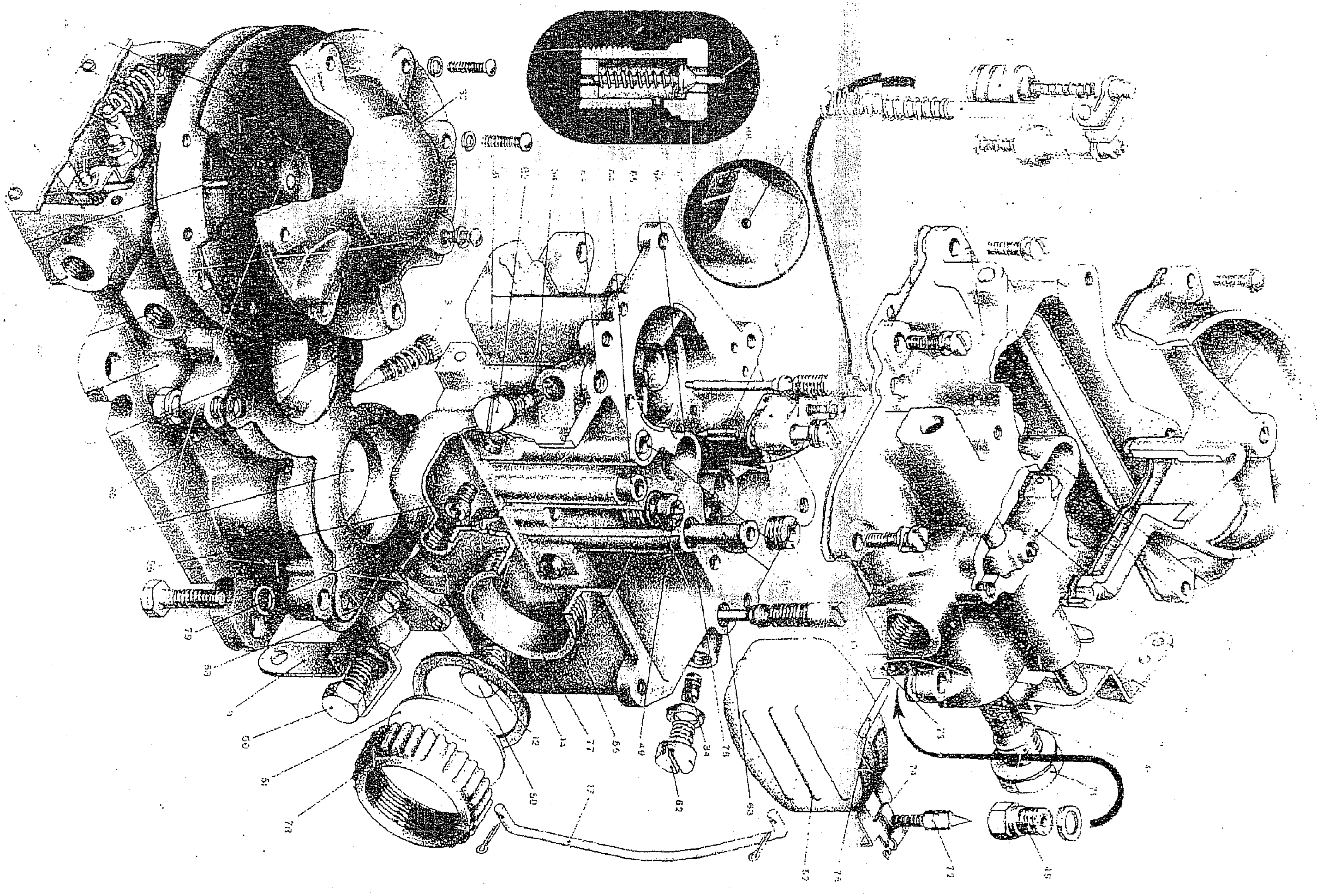
The choke valve control is adjusted by moving the end of the cable fastened to the drive lever on the carburetor. With the choke valve fully open, the knob should be 1-2 mm above the floor, with the knob fully pulled out, the choke valve should be tightly closed.

Periodically (at least once per year), the hinges on the drive cables must be cleaned and lubricated with type TsIATIM-201 high-temperature lubricant (for which purpose the cables are pulled out of their sheaths).



94-a

1 - body of mixing chambers
2 - aperture for installation of tube transmitting rarefaction from mixing chamber of carburetor to vacuum advance mechanism
3 - screw adjusting quantity of emulsion entering mixing chamber at idle
4 - nonadjustable aperture feeding emulsion at idle
5 - throttle valves
6 - adjustable aperture feeding emulsion at idle
7 - large diffuser of mixing chamber
8 - idle fuel jet channel
9 - throttle valve drive shaft driven cam
10 - throttle valve drive shaft driving cam
11 - throttle valve drive lever
12 - throttle valve drive shaft lever limiting stop
13 - accelerator pump needle delivery valve
14 - float bowl
15 - small diffuser of mixing chamber
16 - choke valve manual control lever
17 - throttle valve, economizer and accelerator pump manual control arm
18 - throttle valve, economizer and accelerator pump manual control lever
19 - economizer and accelerator drive shaft
20 - choke valve drive lever shaft
21 - main air jet
22 - balancing channel
23 - main dosing system atomizer jet
24 - choke valve
25 - traverse for mounting of air filter
26 - accelerator pump sprayer
27 - atomizer jet (bridge) of economizer and accelerator pump
28 - carburetor cover air tube flange flange for mounting of air
29 - choke valve poppet valve
30 - cover of float bowl
31 - body of float bowl and diffusers
32 - vacuum chamber cover
33 - body of vacuum chamber of governor drive actuating mechanism
34 - idle air jet
35 - governor vacuum chamber shaft lever (connected to throttle valve shaft)
36 - shaft lever spring
37 - valves connecting mixing chamber to cavity over governor vacuum chamber diaphragm
38 - vacuum chamber diaphragm
39 - idle fuel jet
40 - accelerator pump shaft
41 - drive plate guide shaft
42 - accelerator pump and economizer rocker drive
43 - accelerator pump and economizer drive plate
44 - economizer shaft
45 - accelerator pump piston
46 - float bowl fuel filter
47 - aperture for nipple of fuel line from fuel pump
48 - body of needle valve feeding fuel to float bowl
49 - economizer valve
50 - plug in aperture for installation of main jet
51 - glass viewing window for checking fuel level in float bowl
52 - float
53 - plug for drainage of fuel from float bowl
54 - ball back valve
55 - main fuel jet
56 - emulsion tube
57 - channel connecting space beneath throttle valve to cavity above diaphragm in governor vacuum chamber
58 - aperture for installation of tube connecting cavity above diaphragm in vacuum chamber to body of sensor
59 - governor vacuum jet
60 - aperture for connection of tube transmitting rarefaction from air throat of carburetor to cavity in governor centrifugal sender body
61 - moving adjustment plate
62 - plug in aperture for mounting of idle jets
63 - idle fuel jet compensating well
64 - bushing on control shaft of plate diriving accelerator pump and economizer
65 - economizer channel body
66 - accelerator pump piston cylinder
67 - accelerator pump sprayer
68 - calibrated economizer atomizer jet
69 - air aperture in accelerator pump sprayer channels
70 - float bowl cover gasket
71 - fuel filter plug
72 - float bowl needle valve
73 - float shaft mounting upright
74 - float lever tongue
75 - float lever shaft
76 - main dosing system emulsion well
77 - float bowl viewing window for checking fuel level
78 - viewing window retaining nut
79 - diffuser body gasket
80 - channel connecting mixing chamber to tube transmitting rarefaction to vacuum advance mechanism
81 - channel of adjustable and nonadjustable apertures feeding emulsion at idle
82 - vacuum chamber diaphragm shaft



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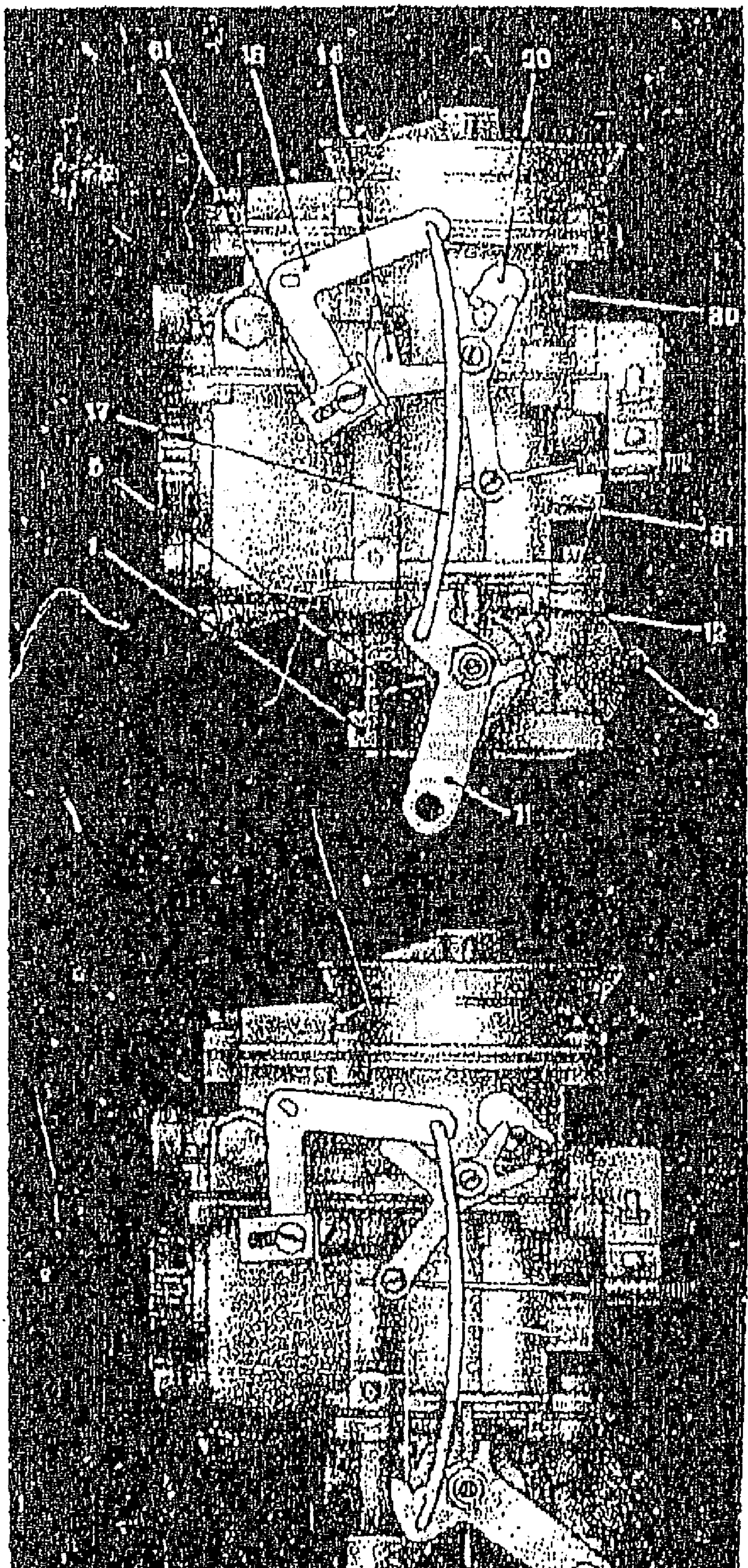
96-a



The dual main dosing system of the carburetor consists of two mixing chambers, two main jets 55, two emulsion tubes 56 and two main air jets 21. Each mixing chamber contains one large diffuser 7 and one small diffuser 15 and one throttle valve 5. In the air throat, formed by cover 30 of the float bowl, there is one common choke valve 24, which adjusts the air feed to the mixing chambers.

The fuel enters the main dosing system through the main fuel jets 55, which are seated in threaded apertures in the channels in the float chamber wall. To remove the jet, remove plug 50 in the outer wall of the float bowl. The fuel from the main jets flows through the channels into well 76, carry emulsion tubes 56; the main air jets 21 are screwed into the tops of the well. Emulsion wells 76 of the main dosing system are connected to the channels of atomizer jet 23 with small diffusers 15. The two diffusers 7 and 15 increase the air velocity through the atomizers and improve mixture formation.

The dual idle system consists of two compensating wells 63 with fuel jets 39 and two idle air jets 34. The fuel enters each well from the float chamber through the main fuel jets 55, the air enters from the air throat through air jets 34. The fuel and air mixture -- emulsion -- travels through channels 81 to the mixing chambers of the carburetor, to the location of the throttle valves 5, through the nonregulated aperture 4 and regulated aperture 6. The composition of the fuel mixture at idle is adjusted by two screws 3, which change the quantity of emulsion entering the two mixing chambers of the carburetor. The quantity of mixture fed into the mixing chamber is adjusted by screw 12, which limits the travel of the throttle valve drive lever and, consequently, the minimum opening of throttle valves 5.

Before adjusting the minimum idle speed of the crankshaft, the setting of the ignition is adjusted, the engine is warmed up and then stopped. Screws 3 are then turned in fully and backed off by 2-2.5 turns, producing a rich mixture. The engine is then started and stop screw 12 is used to set the minimum opening of throttle valves 5 providing stable engine operation. Then, by turning screw 3 to the left or right, the position is found at which the engine idles at the highest speed. Then, after turning screw 12 to the left, screws 3 are once more used to adjust the mixture composition, turning them by one-quarter turn at a time in order to produce stable operation of the engine at the minimum possible idle speed. The best position of screws 12 and 3 is at which provides an idle speed of 475-525 rpm. The idle speed should not be too slow. To check the correctness of adjustment at idle, the throttle valves are quickly opened and immediately closed. If the engine dies when this is done, the idle speed should be set slightly higher.

The mechanical economizer enriches the fuel mixture in the two mixing chambers. It consists of valve 49, common for the two chambers, connected by channels in body 31 to two calibrated atomizer jets 68 in block 27 (the bridge) directed into the two mixing chambers.

The fuel enters body 65 of the economizer valve from float chamber 14 of the carburetor through the end jet (1.66-1.60 mm in diameter) of the economizer in the valve body. The jet is covered with valve 49, which is turned into its seat and pressed against it by a spring. Further, the fuel passes through the side aperture of the economizer body and the atomizer unit 27 (bridge) carrying calibrated atomizer jets 68, 0.7-0.76 mm in diameter.

Opening of the mechanical economizer valve occurs when the throttle valves are wide open.

The throttle valves are open from the cabin of the truck by means of the accelerator pedal through lever 11 or a manual throttle drive system through lever 18. Levers 11 and 18 are interconnected by arm 17. When lever 18 rotates, shaft 19 also rotates, carrying rocker 22, which presses plate 43 and through shaft 44 opens valve 49 of the economizer. Plate 43 is moved vertically by guide rod 41, installed in bushing 64 of body 31.

The mechanically driven accelerator pump is designed to enrich the mixture when the throttle valves are opened suddenly. The pump consists of piston 45 with rod 40, placed in cylinder 66, ball-type back valve 54, which is located on the bottom of the cylinder and covers the fuel outlet from the cylinder, needle-type delivery valve 13 and sprayer 26, from which the fuel moves through two jets 67 into the two mixing chambers of the carburetor. The accelerator pump is driven by the same system as the economizer, its shaft 40 is fastened to plate 43.

Cold engine start system. In order to produce the rich mixture necessary to start the engine when cold, the air throat of the carburetor contains choke valve 24. This valve is closed by the manual choke knob and the cable attached to lever 16. When lever 16 is rotated, it presses on lever 20, rotates the axis of the valve and the valve closes the throat. The quantity of air entering the mixing chamber is thus reduced and the mixture is enriched. If the valve is not sufficiently closed (for a given engine temperature), the fuel mixture will be lean, and if the valve is fully closed the mixture may be too rich, also making it difficult to start the engine. When the choke valve is closed, additional air passes through the valve through the two poppet valves 29. This is particularly necessary after the engine is started and warmed.

Automatic opening of the choke valve after starting is assured by its asymmetrical placement on its shaft, by the clearance between the driving cam 10 and driven cam 9 of the throttle valve parts and by the springs on levers 20 and 18. The spring on lever 20 attempts to close the choke valve, while the air flow passed the choke after the engine is started opens the choke valve unless the choke knob is pulled all the way out. This design prevents excessive enrichment of the mixture and at the same time prevents the engine from stopping with the automatic enrichment of the mixture which results when the engine speed drops.

Easy starting of the engine is also provided by correct placement of throttle valves 5. For reliable starting of the engine, the throttle valves should be slightly open. When the choke valve is fully closed, the throttle valves should automatically open to an angle of 12°, corresponding to a distance between the wall of the mixing chamber and the edge of the throttle valve of 1.2 mm. The clearance allowed with the throttle valve fully closed is not over 0.06 mm. The angle by which the throttle valve is opened is adjusted by moving plate 61, a projection on which contacts the arm of lever 16 when choke valve 24 is closed.

In adjusting the throttle valve controls, the accelerator pedal is set at an angle of 111-115° to the horizontal floor of the cabin by a block. Before it is connected with the drive cable, lever 11 is placed so that it rests against screw 12, at which point the throttle valves are closed; the position of lever 18 of the manual throttle is determined by the length of cable 17 and corresponds to maximum rotation of its lower arm in the direction toward the axis of the carburetor. Full opening of the throttle valves should occur when the accelerator pedal is fully depressed. The control spring should allow a free travel of the pedal of 4 mm. The manual choke control is adjusted by changing the length of the cable so that when the choke knob is pulled fully out, the choke valve is fully closed; when the valve is fully open, the knob should be pressed downward, 1-2 mm above the floor.

Diagram of Operation of Carburetor

Operation of the carburetor at idle. After the engine is started, it must be allowed to operate at the idle to warmup; during this time, throttle valves 18 in the carburetor will be closed, choke valve 48 open.

The fuel enters float bowl 8 through the fuel line, the nipple of which is screwed into threaded aperture 61. When the float bowl is being filled, the fuel passes through filter 57, bypassing needle valve 48. After float bowl 8 is filled with fuel to the required level, float 60 moves upward and tongue 59 on its lever, passing against the needle valve moves it upward, preventing more fuel from entering the float bowl.

When throttle valves 18 are closed, rarefaction from mixing chamber 17 is transmitted into compensation wells 9 to the idle jets 55 through adjustable apertures 15 through channels 14. The fuel enters the compensation wells from the float chamber through main fuel jets 10, air enters the wells from air float 45 through idle air jets 52. The emulsion formed in wells 9 goes from there through idle channels 14 to adjustable apertures 15; additional air from mixing chambers 17 passes through non-adjustable apertures 13 (above the closed throttle valves), improving the breakup of the fuel and making the mixture slightly leaner. As the throttle valves are opened, the rarefaction in compensation wells 9 begins to be transmitted also through non-adjustable apertures 13, providing the necessary enrichment of the mixture for smooth transition to operation of the main fuel supply system.

As the crankshaft speed is increased, the speed with which the air flows into the mixing chamber increases, which is facilitated by installation of the small diffuser 39 and large diffuser 23 in the carburetor. The fuel flows out more rapidly with increasing air speed, causing enrichment of the mixture.

The main dosing system of the carburetor uses the principle of pneumatic deceleration of the fuel (compensation of mixture composition by emulsion). According to this principle, additional air is fed to the point where the fuel flows out, reducing the rarefaction and, moving with the fuel, forming an emulsion. As a result, the carburetor produces an economical mixture of fuel and air.

Operation of carburetor under partial load. As the throttle valves 18 are opened, when the air flow reaches 20-25 kg/hr, the main dosing system begins to operate, and operates together with the idle system for sometime. The fuel from float bowl 8 passes through the main fuel jets 10 into emulsion tubes 11 and wells 28. In the wells, it is mixed with air entering through main air jets 54, and forms an emulsion, which moves through atomizers 53 into small diffusers 39 and, mixing with the air, forms the combustible mixture. This mixture flows down past throttle valves 18 into the cylinders of the engine.

As the rarefaction in the small diffusers 39 increases, the level of fuel in emulsion wells 28 drops. Additional air, entering through the main air jets 54 into emulsion tubes 11, then decreases the rarefaction in the main dosing system, thus decreasing the flow of fuel through main fuel jets 10 and assuring an economical composition of the mixture.

Operation of the carburetor under full load. Enrichment of the mixture in the carburetor begins when throttle valves 18 are set in the position 5-7° short of full opening. When this happens, lever 26 and arm 27 move, the rocker arm shaft 37 pushes against plate 35 and shaft 33 of the economizer. Shaft 33 opens the path for additional fuel from float bowl 8 through valve 32 and channel 21 through the special calibrated atomizer jets 42 of the economizer into large diffusers 23 in the main dosing system. The mixture fed into the cylinders of the engine is thus enriched, to support engine operation under full load.

Operation of the carburetor in acceleration. When the truck is accelerated and throttle valves 18 are opened rapidly, plate 35, compressing the spring of piston 31 of the accelerator pump, moves the piston downward rapidly. This sprays fuel in through channel 20, needle valve 19, sprayer 46 and atomizer 43 into large diffusers 23, providing the necessary enrichment of the mixture. Excess flow of fuel with the throttle valves held in one position is prevented by valve 19 and the delivery of additional air through air apertures 47 into atomizer 43.

Engine governor. Operation at excessively high engine speeds causes increased wear of the engine. The maximum crankshaft speed is regulated by a pneumatic-centrifugal governor. The actuating mechanism of the governor is mounted in body 79 and fastened to the carburetor, its centrifugal sensor is mounted in body 66, fastened to the engine distributor gear cover.

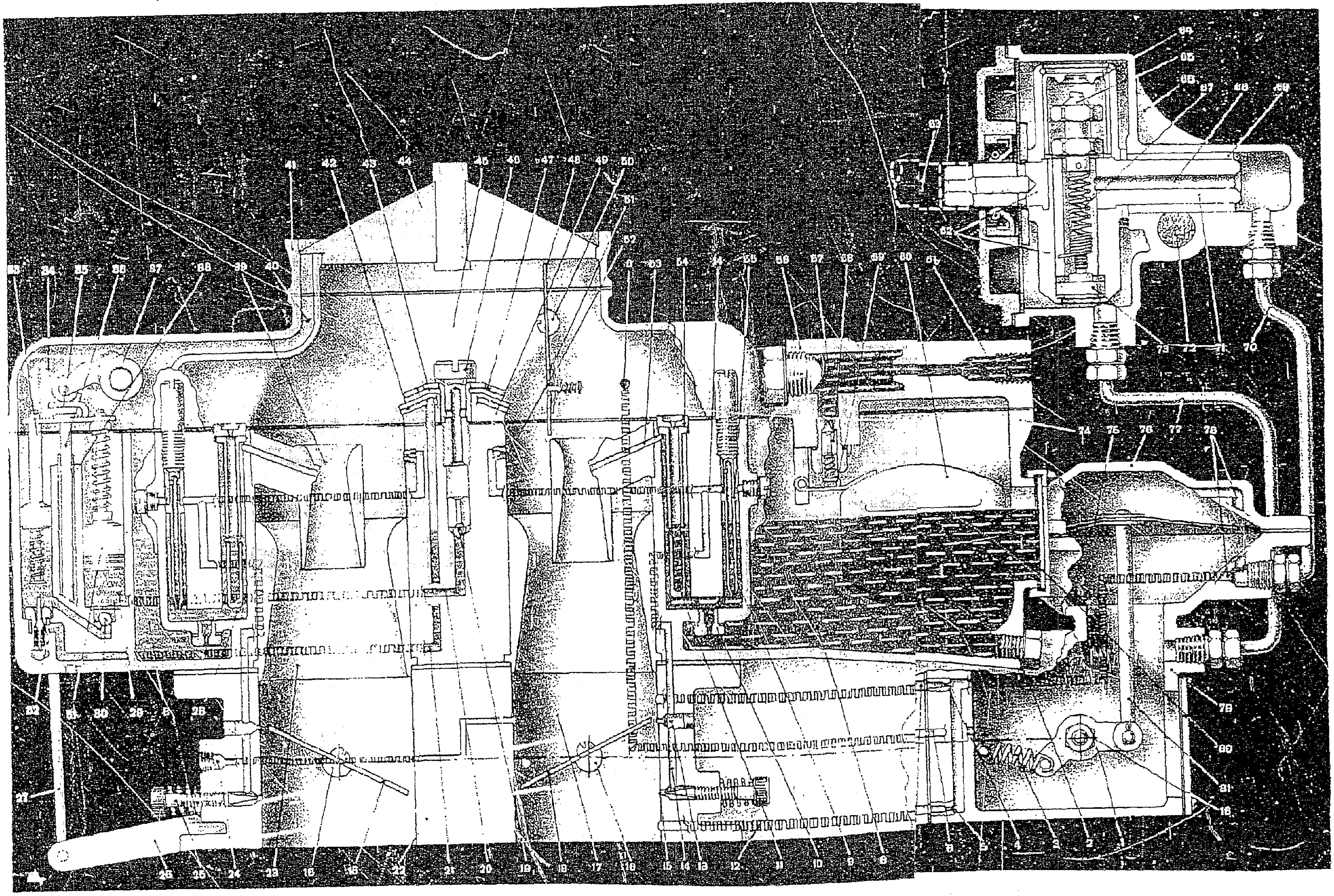
Body 66 of the centrifugal sensor is cast of zinc alloy. Within the body is rotor 62 on metal ceramic bushing 69. The rotor is driven by the front end of cam shaft 63 of the engine. In the rotor, valve 65 is mounted on spring 67, while channel 68 extends through the middle of rotor shaft 71. The body of the sensor is connected by tube 70 to the space over diaphragm 75 of the actuating mechanism vacuum chamber, while tube 77 connects it to the space beneath diaphragm 75, connected by channel 6 to the air throat 45 of the carburetor.

Operation of engine governor. When the crankshaft reaches the maximum speed, valve 65 of the sensor moves under the influence of centrifugal force, stretching spring 67, and closes the aperture in seat 64. This prevents the flow of air from air throat 45 into the space located above diaphragm 75 of the sensor. A rarefaction is created above diaphragm 75, shaft 81 moves upward and rotates shaft 16 by means of lever 1, closing throttle valves 18.

When the engine speed decreases, valve 65 moves away from the aperture in seat 64, and the space over diaphragm 75 is connected through the sensor to air throat 45 of the carburetor; diaphragm 75 moves downward under the influence of spring 3, lever 1 and shaft 81, while shaft 16 rotates, opening throttle valves 18, allowing the engine speed to increase. In this manner, the engine speed is maintained constant at 3,200-3,400 rpm.

The rotating speed of the crankshaft of the engine can increase excessively if the load is suddenly removed. For example, if the truck is driven downhill, the engine speed increases, which is accompanied by an increase in rarefaction beneath throttle valves 18. This rarefaction is transmitted through channels 12 and 7, jets 5 and 4 and channel 78 into the space over diaphragm 75. Diaphragm 75 and shaft 81 then move upward and lever 1 rotates shaft 16, closing throttle valves 18 and limiting the engine speed to 3,450-3,650 rpm.

1 - governor vacuum chamber shaft lever
2 - plug in aperture for drainage of gasoline from float bowl
3 - shaft lever spring
4 - governor air jet
5 - governor vacuum jet
6 - channel feeding air to throat of carburetor in body of sensor
7 - channel connecting mixing chamber to cavity over diaphragm in vacuum chamber of governor
8 - float bowl
9 - idle fuel jet compensation well
10 - main fuel jet
11 - emulsion tube
12 - channel connecting space beneath throttle valve to cavity above diaphragm of governor vacuum chamber
13 - non-adjustable aperture feeding emulsion at idle
14 - idle fuel jet channel
15 - adjustable aperture for feeding emulsion at idle
16 - throttle valve shaft
17 - mixing chamber
18 - throttle valve
19 - accelerator pump needle valve
20 - channel feeding fuel to accelerator pump sprayer
21 - channel feeding fuel to economizer jet
22 - mixing chamber body
23 - large diffuser of mixing chamber
24 - aperture for installation of tube transmitting rarefaction from mixing chamber of carburetor to vacuum advance mechanism
25 - screw adjusting quantity of emulsion fed to mixing chamber at idle
26 - throttle valve drive lever
27 - throttle valve, economizer and accelerator pump control arm
28 - main dosing system emulsion well
29 - accelerator pump cylinder
30 - ball back valve
31 - accelerator pump piston
32 - economizer valve
33 - economizer shaft
34 - manual throttle, economizer and accelerator pump control lever
35 - plate driving accelerator pump and economizer
36 - drive plate guide shaft
37 - economizer and accelerator pump drive shaft
38 - economizer cylinder
39 - small diffuser of mixing chamber
40 - balancing channel
41 - flange of cover for air cleaner
42 - calibrated economizer jet
43 - accelerator pump atomizer
44 - traverse for mounting of air cleaner
45 - air throat
46 - accelerator pump sprayer
47 - accelerator pump atomizer channel air aperture
48 - air valve
49 - atomizer section (bridge) of accelerator pump and economizer
50 - choke valve shaft
51 - poppet valve
52 - idle air jet
53 - main dosing system atomizer
54 - main air jet
55 - idle fuel jet
56 - float bowl cover
57 - float bowl fuel filter
58 - float bowl needle valve
59 - float lever tongue
60 - fuel float
61 - aperture for fuel line from fuel pump
62 - sensor rotor
63 - front end of cam shaft
64 - valve seat with aperture for transmission of rarefaction to rotor shaft channel
65 - sensor valve
66 - sensor body
67 - sensor valve spring
68 - channel in rotor shaft for transmission of rarefaction to cavity above diaphragm in governor vacuum chamber
69 - metal ceramic porous bushing
70 - tube transmitting rarefaction from sensor to cavity above diaphragm in governor vacuum chamber
71 - rotor shaft
72 - lubricating packing
73 - governor adjusting screw
74 - float bowl and diffuser body
75 - vacuum chamber diaphragm
76 - vacuum chamber cover
77 - tube transmitting air from air throat of carburetor to internal cavity of centrifugal governor sensor
78 - channels connecting mixing chamber to cavity over diaphragm in governor vacuum chamber
79 - body of governor vacuum chamber
80 - float bowl inspection window
81 - vacuum chamber diaphragm shaft



105-a

Basic Data

Type of electrical equipment -- single-wire, with parallel connection of direct current supply and negative ground.

Modifications of electrical equipment -- on basic models of GAZ-66, unshielded electrical equipment used with high-power, high-reliability equipment, designed for operation of a multicylinder truck engine with good cross country ability under difficult conditions. In order to reduce radio interference, GAZ-66-03, GAZ-66-04 and GAZ-66-05 versions use shielded electrical equipment, plus additional devices for protection of radio equipment from interference.

General design of electric equipment of the GAZ-66-01. The current supply is a six-element type 6-ST-68 starter battery and a type G130 two-pole, two-brush, shunt-wound direct current generator with a type RR130 three-element voltage regulator.

Nominal voltage -- 12 v
Battery capacity -- 68 a-hr
Discharge current in 10 hour discharge mode -- 6.8 a
Battery filled -- 5 l
Battery weight -- 30.4 kg
Battery power -- 350 w
Nominal load current -- 28 a
Idle current (operating in electric motor mode) -- 6 a
Minimum armature rotation rate (developing 12.5 v at 20° with zero load current) -- 450 rpm
Transfer number from crankshaft -- 2.06
Generator weight -- 11 kg

The sources of direct current on the truck -- battery 58, type 6-ST-68EM and generator 25, type G130 with three-element voltage regulator 3, type RR130 -- are connected by wires and combined ignition and starter switch 22. Discharging of battery 58 is indicated by warning light 34 on the dashboard. When generator 25 becomes the source of current and begins to charge the battery, light 34 goes out.

The engine is started by series-wound model ST130-B electric starter motor 45, connected to the battery. Reliable connection of the negative terminal of battery 58 to ground is achieved using a special device -- ground switch 54. Switch 22 (lock) type VK324 has three positions: the zero position, everything switched off; the first position, when the switch is rotated clockwise, ignition switched on; and the second (not fixed) position, when the key is rotated further to the right and held, ignition and starter switched on.

The truck uses a battery system of ignition of the fuel mixture in the cylinders. High voltage current is induced in type B13 ignition coil 59. The operation of the coil is controlled by a mechanical eight-cylinder breaker 61, the distribution of the current induced among sparkplugs 41 is controlled by distributor 60, type R13-V, installed with the breaker.

The truck is equipped with a reliable system for illumination of the road, turn signals and internal illumination.

Control of headlights 2, parking lights 1, tail lights 64 and 69 and light 32 illuminating instrument panel 27 is through the central light switch 16, type P38-B, and front dimmer switch 17, type P39. When the knob of switch 16 is in position I, all lights are turned off; in position II, lights 32, marker lights (6 cd), parking lights 1 or the low beam (40 w) of headlights 2 (depending on the position of switch 17), marker lights (3 cd), bulbs 66 and 68 of tail lights 64 and 69 are turned on. Bulb 68 also illuminates the license plate; in position III, the low (40 w) or high (50 w) beams of the headlights (depending on the position of foot switch 17), tail lights and

instrument panel lights are on. The intensity of illumination of the instrument panel can be adjusted by rotating switch lever 16, which controls a rheostat built into the switch.

Dimmer switch 17 has two positions. When switch 16 is in position II, it controls the parking lights or the low beam of the headlights; in position III, it controls the low or high beam of the headlights. When the high beams are turned on, warning light 30 with its blue filter, mounted in speedometer 29, is on. Additional illumination of the road and the area around it can be provided by spotlight 15 (50 cd), turned on by switch 19.

Turns are signaled using electromagnetic interrupter 14 (type RS 57), the turn signal lights and switch 18, to which parking lights 1 and tail lights 64 and 69 are connected. Green light 36 on the instrument panel flashes to indicate when the turn signals are turned on.

Braking is signaled using hydraulic switch 5 and stop lights 65, giving the "stop" signal to traffic behind the truck.

If the cooling fluid in the temperature becomes too hot, warning light 33, connected to sensor 23 in the upper tank of the radiator switches on. The lamp begins to burn when the temperature of the cooling fluid reaches 105°. The instrument panel also carries electromagnetic indicator 28 showing the temperature of the cooling fluid in the engine, with semiconductor sensor 24, type TM100, and the type UB 103 electromagnetic fuel level gauge 31, connected by switch 20 to senders 53 and 63, type BM112A, in the left and right fuel tanks. When the oil pressure in the engine drops to 0.4-0.7 kg/cm^2, type MM111 sender 26, installed in the lubrication system, makes its connection; warning lamp 35 on the dashboard lights up.

Electric horn 6 is connected through fuse 12 to the circuit of battery 58. Horn button 43 is installed on the steering wheel.

The cabin, cargo platform and space under the hood are illuminated by lights 62, 57 and 7. A sound signal can be given from the body into the cabin by means of electromagnetic relay 21 (buzzer), type RS508, and switch 55.

The electrical equipment system includes motors 37 and 38 and two-speed windshield wiper 39, supporting the operation of the heating and ventilation system for the cabin and cleaning the windshield.

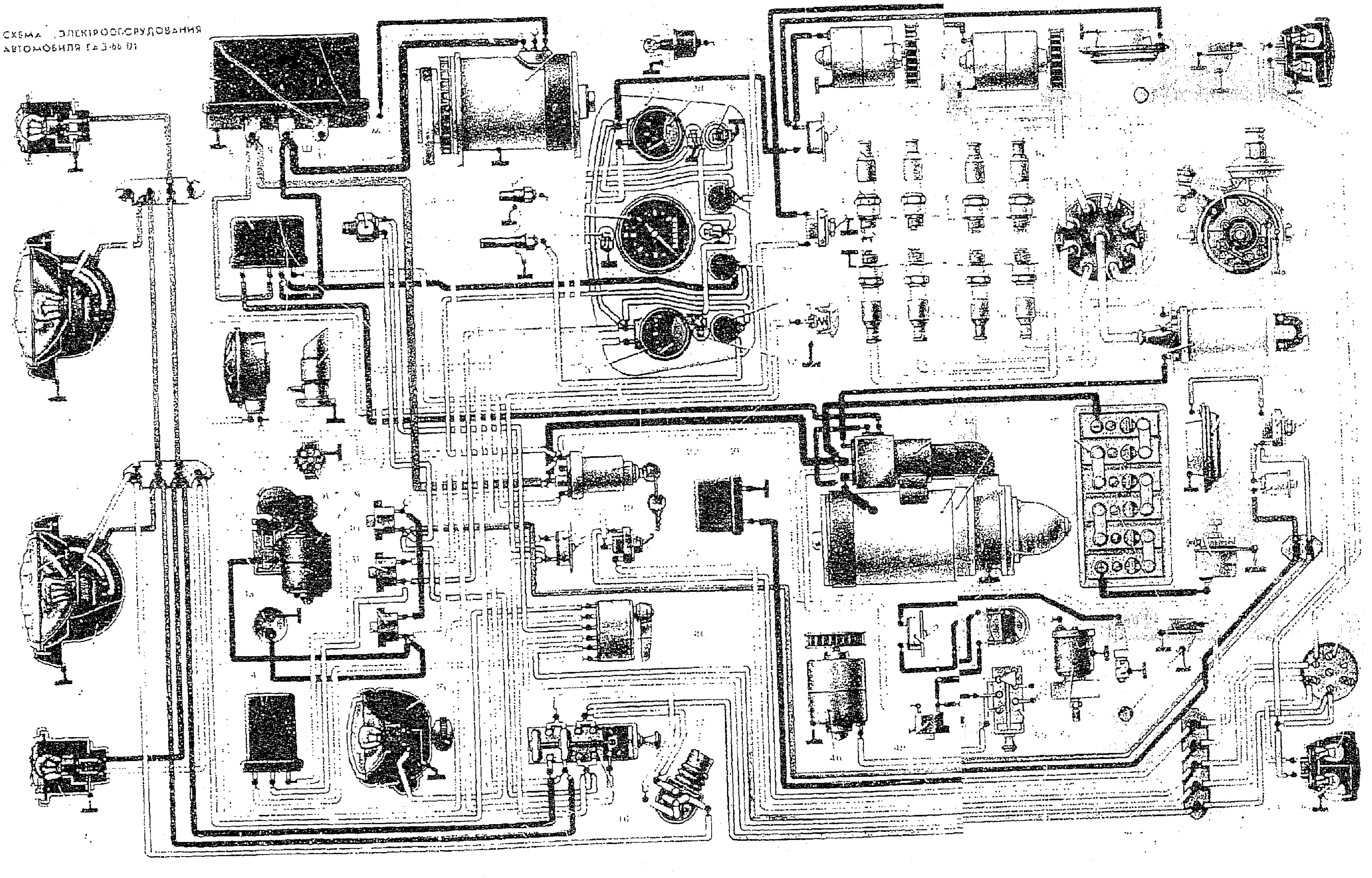
When the engine must be started at low temperatures, the electrical equipment of the starter heater is used, including electric motor 46 of the starter heater, electromagnetic valve 51 on the fuel line, single-wire glow plug 52, test spiral 49 and switches 47 and 50.

Plug 67 allows the electrical equipment on the trailer to be connected to the electrical system of the truck.

The peculiarities of the shielded electrical equipment system will be discussed on other pages.

1 - PF101 front light (parking light) with dual filament type A27 bulb (12 v) -- turn signal (21 cd) and marker light (6 cd)
2 - type FG122-B headlight with asymmetrical lens and two-filament type $A\frac{12-50}{12-40}$ bulb (12 v), high (50 w) and low (40 w) beams
3 - three-element voltage regulator type RR130
4 - supplementary type RS502 electromagnetic starter relay
5 - type VK12 hydraulic switch for brake light
6 - type S56-G horn
7 - type PD304 under-hood light with type A24 bulb (12 v, 3 cd)
8 - windshield wiper switch (3 positions: off, low speed, high speed)
9 - electric two-speed type SL115 windshield wiper with two blades
10 - type PR2-B (20 a) bimetallic button-type fuse for lights
11 - type PR315 (15 a) bimetallic button-type fuse for turn signals and cabin heater motors
12 - type PR310 bimetallic button type (10 a) fuse for horn and windshield wiper
13 - portable light jack
14 - type RS57 turn signal electromagnetic interrupter (breaker)
15 - rotating spotlight type FG-16V with two-filament type A 40 bulb (12 v, 50 + 21 cd); only 50 cd filament used for illumination
16 - central light switch type P38-B
17 - type P39 foot switch
18 - type P118 turn signal switch
19 - spotlight switch
20 - fuel gauge switch
21 - type RS508 signal (buzzer) for signaling from body to cabin
22 - type VK324 or VK21-K (lock) ignition and starter switch
23 - type TM104-T water temperature sensor
24 - type TM100 engine cooling fluid temperature sensor
25 - type G130-V two-pole direct current generator
26 - type MM111 oil pressure warning light sender
27 - type KP103 instrument panel
28 - type UK105 gauge indicating temperature of cooling fluid in engine
29 - type SP24-V electric speedometer
30 - high beam warning light (with blue light filter)
31 - type UB103 fuel gauge
32 - dash panel light
33 - radiator cooling fluid temperature warning light (with red filter)
34 - warning light indicating battery discharge (with red light filter) (lamp lights when battery is discharging)
35 - oil pressure warning light (with red filter)
36 - engine speed warning light (with green filter)
37 - electric motor of fan feeding hot air to driver and defrosting drivers side of windshield
38 - ME202 electric motor of heater warming passengers side of cabin and defrosting right windshield
39 - heater and defroster fan switch
40 - sparkplug connector
41 - sparkplug
42 - cabin light switch
43 - electric horn button
44 - RS130 electromagnetic starter solenoid
45 - ST130-B electric starter motor
46 - starter heater fan motor
47 - glow plug switch
48 - bimetallic type PR2-B button fuse (20 a) for starter heater
49 - starter heater test spiral
50 - starter heater motor switch
51 - electromagnetic valve regulating fuel feed to starter heater
52 - single-wire type SR65-A glow plug igniting fuel in starter heater
53 - type BM112-A sender indicating fuel level in left tank
54 - type VK318 ground switch
55 - buzzer signal switch
56 - platform light switch
57 - platform light
58 - 6-ST-68EM battery
59 - miniature oil-filled ignition coil type B13
60 - R13-V eight-plug high voltage distributor
61 - R13-V distributor breaker
62 - PK201 light with A24 (12 v, 3 cd) bulb illuminating cabin
63 - BM112A right tank fuel level sender
64 - FP101-B right tail light
65 - A26 bulb (12 v, 21 cd) of tail light (turned on for brakes and turn signals)
66 - A24 bulb (12 v, 3 cd) of right tail light (marker light)
67 - PS300 jack for connection of trailer electrical equipment
68 - A24 bulb (12 v, 3 cd) of left tail light (marker light also illuminates license plate)
69 - FP101 left tail light

Схема электрооборудования автомобиля ГАЗ-66-01



Current Sources and Voltage Regulator

Battery. Type 6-ST-68EM starter-type acid battery 31 used on the truck consists of six series-connected cells, has a nominal voltage of 12 v and a capacity of 68 a·hr (in 10 hour discharge modes). The battery is mounted in a six-chamber ebonite (E) body, its separators are made of miplast (M) plastic. If the type designation of the battery contains the letter M followed by the letters S and Z, this means that reinforced miplast separators combined with glass fiber are used, and the battery is supplied with dry-charged plates. In this case, the full type designation of the battery is 6-ST-68EMSZ.

Each battery has six negative and five positive plates.

Maintenance. Electrolyte is poured in through the filler holes in covers 34 of the cells, closed with plugs 36. The electrolyte is prepared using chemically pure battery acid (GOST 667-53) and distilled water (GOST 6709-53).

A single standard for electrolyte density is used in the northern, central and southern regions of the country both summer and winter, 1.29, 1.27 and 1.25 respectively. In regions with severe continental climate, the density should be 1.31 in winter and 1.27 in summer. At the plant, the electrolyte density in the battery at the end of charging is brought up to 1.27.

The level of electrolyte should be 10-15 mm above the upper edge of the plates. It must be checked at least once per month in winter, each 15 days in summer and during each TO-1 cycle.

Dry-charged batteries may be installed on the truck without preliminary charging following three-hour soaking of the plates by electrolyte. The battery should be charged at the first opportunity.

The battery charge is checked during TO-1 and at least once per month, by using a hydrometer to measure the density of the electrolyte and a load fork to determine the voltage of the battery as it is discharged with a current of up to 200 a. In the winter, the battery can be allowed to discharge by 25% of its capacity, in the summer -- by 50%. This degree of charge corresponds to an electrolyte density reduction in the summer from 1.27 to 1.19, or to 1.23 in the winter and a drop in the voltage when tested by the loading fork of from 2.2 v to 1.5-1.6 v summer and 1.6-1.7 v winter. When the battery is discharged down to these norms, it must be fully charged at least once each three months.

Once each year, the battery is put through a testing and training cycle (TTC). In this cycle, the battery is charged to the norm, after which it is discharged in the 10 hour mode to a voltage of 1.7 v and once more charged.

During TO-1, the surface of the battery is rubbed off with a clean rag, wet with a 10% solution of ammonium hydroxide or caustic soda; ventilator hole 35 are cleared of dirt and ice, cracks on the surface of the resin and monoblock are repaired; the mounting of the battery and cables is checked; the terminals are cleaned of oxides, and their noncontact surfaces are lubricated with technical vaseline after the cables are attached.

Direct current generator. The main source of direct current on the truck during operation is the type G130-V two-pole, two-brush, 350 w direct current generator, designed for a nominal load current of 28 a and a voltage of 12-15 v.

Body 1 and pole shoes 5 have the residual magnetism necessary for self-excitation of the generator at the beginning of operation.

The alternating current induced in the sections as the armature rotates is rectified by collector 4, consisting of 40 copper plates, insulated from each other and from the armature shaft, to which the ends of the sections are soldered.

Generator rear cover 6 carries the brush holder for positive brush 10, insulated from ground, and the brush holder of negative brush 11, connected to ground.

The brushes are pressed tightly against the collector with a force of 800-1,300 g by the brush springs.

Covers 6 and 13 of the generator contain ventilation channels 9, through which a stream of air is drawn by blades 17 of the fan to cool the generator.

The GAZ-66-03 truck carries a model G130-E shielded generator, equipped with two additional special terminals marked Sh and Ya for the shielding conductors. In order to decrease radio interference, two brushes connecting the drive pulley with ground are sometimes installed.

Maintenance. Correct operation of the generator must be tested each day using warning lamp 21, which should go out when the generator begins to operate.

During TO-1, the external surface of the generator is washed, the mounting of the wires, tension of drive belt 14, proper installation of pulley 16 and of the generator on the engine are checked, and the cover mounting lugs are tightened.

During TO-2, the protective strip is removed, the brushes, brush holders and collector are inspected, the internal cavity of the generator is blown

out with compressed air and the pressure of the brushes is checked.

Each third TO-2, the generator is removed, dissembled and cleaned, the condition of the windings, collector, brushes, body, covers and bearings is checked.

Worn brushes less than 14 mm high or with damaged contact surfaces are replaced. The new brushes are turned to fit the collector. In case of accumulation of oil, the collector is washed with gasoline or if burned, it is cleaned with a fine grade of sandpaper.

The bearing of the generator is lubricated at the factory with a special high-temperature lubricant No 158 (VTU TNZ-100 -- 61), which is removed following 35,00-40,000 km. In operation, when the lubrication in the bearing is replaced, type TsIATIM-201 heat-resistant lubricant is used to fill the free volume of the bearing two-thirds full. This lubricant need not be changed for an additional 25,00 to 30,000 km. If it is impossible to change the lubricant, 8 to 10 drops of oil as used in the engine should be inserted in front bearing 15 each 6,000 km, and type 1-13 or 1-13s high-temperature lubricant should be put in rear bearing 7.

Voltage regulator. The operating modes of the generator are regulated, it is protected from overloading and the voltage is maintained constant by the RR130 three-element voltage regulator. It consists of the back current relay (BCR), current limitor (CL) and voltage regulator (VR), mounted on cast base 37.

Core 70 of the BCR carries shunted winding 39 and series winding 71. The shunt winding consists of 1,420 turns of copper wire and a series connected winding of (75 turns) of constantan wire for temperature compensation. The series winding (12.25 turns) consists of rectangular cross-section copper wire. Armature 43 of the BCR is suspended on an elastic bimetallic plate (BMP) 44, eliminating the influence of the temperature state of the BCR at the moment when contact 41 are closed on the stability of the operating mode of the generator.

The back current relay automatically closes the circuit between the generator and the battery when the voltage of the generator is greater than the voltage of the battery, and opens it when this voltage drops. The back current at the moment of opening of the contacts should be between 0.5 and 6 a.

Core 65 of the CL carries accelerator winding 52 (14 turns) and series windings 64 (15 turns). Armature 49 of the CL is mounted on plate 48 made of chrome-manganese bronze. In order to increase the life of contacts 51 of the CL, they are made of various electrical corrosion-resistant metals: the upper of silver, the lower of tungsten.

Core 59 of the VR carries two windings: the main shunt winding 61 (1,300 turns) and balancing winding 58 (35 turns). The slight magnetic flux created by the balancing winding is directed opposite to the magnetic flux created by the shunt winding, providing for better maintenance of constant voltage of

the generator as the rotating speed of the armature varies.

In order to maintain the voltage constant as the temperature changes, the support of armature 57 of the VR consists of bimetallic plate 44, while the circuit of its shunt winding 61 contains 13 ohm accelerator resistor 66, made of nichrome. This resistor also helps to increase the oscillating frequency of armature 57.

When contacts 41 of the BCR open, which occurs at a voltage of 12.2-13.2 v, the load current from the generator moves to terminal Ya of the voltage regulator, through the series windings 64 of the CL and 71 of the BCR to frame 69 of the BCR and through conductor 45, plate 42 of armature 43, contacts 41 and upright 38 to terminal B of the voltage regulator, then on to terminal AM of switch 22 and to the power-consuming devices (for example, to charge battery 31), then from them to ground and to the negative pole of the generator. The current reaches excitor winding 2 of the generator through accelerator winding 52 of the CL through frame 67, through armature 49 and contacts 51 of the CL, upright 54, balancing winding 58, upright 55 of the VR, contacts 56, armature 57, frame 60, terminals Sh of the voltage regulator and the generator. At the same time, the current from frame 67 passes through resistor 66 to shunt winding 61 of the VR, magnetizing core 59.

If the current consumed exceeds 26.5-29 a, the magnetization of core 65 of the CL increases to the point that contacts 51 are opened; the current then reaches the excitor winding 2 through additional resistor 63 (30 ohms) and in parallel through resistors 66 and 62, 13 and 80 ohms respectively.

When the generator voltage increases to 13.3-15 v (depending on the setting), core 59 of the VR is magnetized to the point that it overcomes the resistance of spring 46 and contact 56 of the VR open, after which current reaches the excitor winding only through resistor 13, 80 ohms; the magnetic flux of the excitor winding decreases and the generator voltage drops.

Maintenance. The operation of the voltage regulator is checked daily by means of warning light 21. During TO-1, the tightness of the terminal screws

and fastening of the wires is checked, the body of the voltage regulator is cleaned and the fasteners holding the body to the front wall of the cabin are tightened. Particular attention must be given to the connection between the ground of the voltage regulator and the ground on the generator. During TO-2, the adjustment is checked and further adjustment performed if needed. Each three TO-2 cycles, twice per year in preparation for summer and winter operating conditions, the adjustment parameters of the voltage regulator are fully checked. The regulated voltage is set within the following limits: in summer in the southern area of the country 13.3-13.7 v, in the central and northern regions 13.6-14.7 v; in winter in the southern regions 14.3-14.7 v, in the central and northern regions 14.6-15 v.

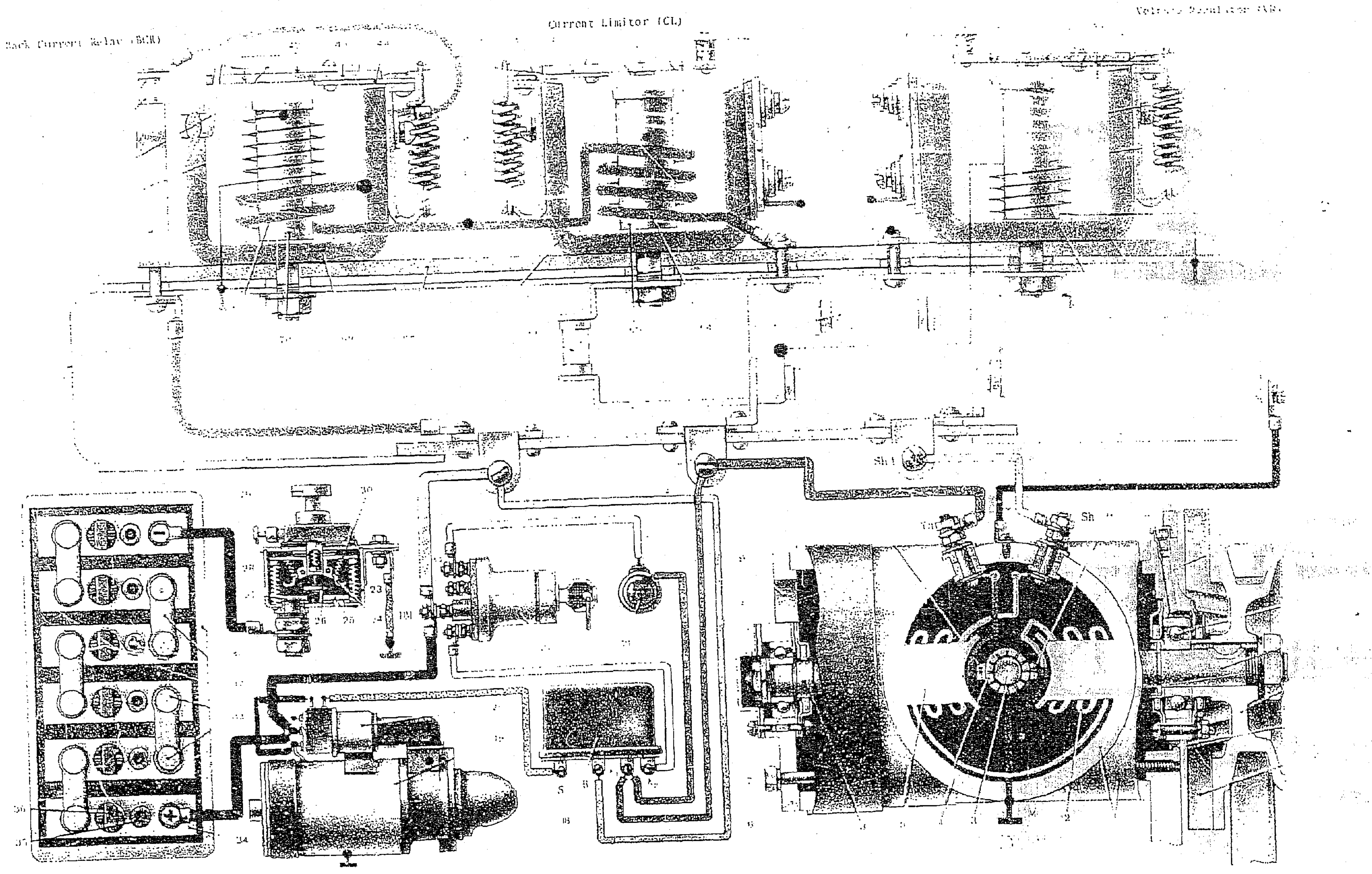
When the cover of the voltage regulator is removed, the parts are cleaned of dirt and corrosion, the gasket is checked, the electrical contacts, insulation, resistances, tightness of screws and nuts are tested. Burned contacts are cleaned, the clearances between armatures, cores and contacts shown on the figure are checked and adjusted as necessary.

1 - body of G130-V generator
2 - excitor winding
3 - armature shaft
4 - armature winding collector
5 - pole shoe
6 - rear cover of generator body
7 - rear bearing of generator shaft
8 - protective cover of bearing
9 - ventilation channels in covers
10 - positive brush
11 - negative brush
12 - bearing lubrication point
13 - generator body front cover
14 - generator drive belt
15 - front ball bearing
16 - generator drive pulley
17 - generator cooling fan blades
18 - RS502 supplementary starter relay
19 - ST130-B starter motor
20 - RS 130 electromagnetic starter solenoid
21 - battery discharge warning light
22 - VK21-K ignition and starter switch (lock)
23 - VK318 ground switch body
24 - main contact of switch
25 - lower contact, connected to ground
26 - moving supplementary spark-damping contact (precontact) of switch
27 - contact bolt
34 - battery cell cover
35 - ventilation aperture
36 - filler plug
37 - base of RR130 voltage regulator
38 - adjustable upright supporting nonmoving contacts of back current relay (BCR)
39 - BCR shunt winding
40 - armature travel limitor
41 - BCR contacts
42 - elastic contact plate of BCR armature
43 - BCR armature
44 - elastic bimetallic plate supporting armature
45 - armature wires shunting bimetallic plate
46 - armature spring
47 - spring bracket
48 - plate supporting CL armature
49 - current limitor (CL) armature
50 - diamagnetic stop
51 - CL contacts
52 - CL accelerator winding
53 - nonmoving contact upright adjusting aperture screws
54 - adjustable CL nonmoving contact upright
55 - voltage regulator nonmoving contact adjustable upright
56 - VR contacts
57 - VR armature
58 - VR balancer winding
59 - VR core

67

28 - side lever fixing central shaft
29 - central contact shaft
30 - contact traverse
31 - 6-ST-68EM battery
32 - battery cross piece connecting elements
33 - plate pole rods

60 - VR frame
61 - VR shunt winding
62 - 80 ohm supplementary resistor
63 - 30 ohm supplementary resistor
64 - CL series windings
65 - CL core
66 - 13 ohm temperature compensating accelerator winding
67 - CR frame
68 - base insulation plates
69 - BCR frame
70 - BCR core
71 - BCR series winding


Back Current Relay (BCR)
Current Limitor (CL)
Voltage Regulator (VR)
Sh
Sh1
DM
23
24
25
26
30
5
8
34
36
37

118-a

118

Basic Data

Distributor -- eight-way, type R13-V or shielded type R105.
Ignition system -- dash battery type.
Coil -- oil-filled, sealed, type B13 or shielded type B5-A.
Sparkplugs -- A11U or A15B shielded.

The R13-V distributor consists of the breaker in the low voltage circuit and the high voltage distributor, carrying the current induced in the coil.

The distributor is mounted in a cast iron body 2, its driven shaft 1 installed in two bushings 3, rotated by the cam shaft of the engine. In order to connect the distributor shaft to the drive shaft in a strictly defined position, setting blade 47 is displaced relative to the shaft axis by 0.8 mm. Body 2 carries nonmoving disk 14 with ball bearing 53, onto which moving disk 42 carrying the breaker mechanism is fastened. The interruptor consists of lever 39 (hammer) and nonmiving contact upright 41 (anvil), held by screws 15 and 37 to disk 42, which is connected by wire 52 with ground. The breaker is installed on shaft 36 and insulated from ground by the bushings on the shaft and plastic bearing 58.

Contacts 59 and 60 of the breaker are opened by eight-sided cam 20 installed on shaft 1. The cam opens the contacts each 45 ± 1° of rotation of shaft 1; the angle of the closed contacts 59 and 60 is 30°. Due to the relatively low angle of the closed state of the contacts and the high speed of the crankshaft, the clearance between the breaker points must be checked periodically. This clearance should be 0.3-0.4 mm. The clearance is adjusted by moving the upright with eccentric screw 37 with screw 15 loose.

Contacts 59 and 60 are pushed together tightly by flat spring 38, the design force of which should be 500-650 g.

The practical service life of the distributor points is 25,000 to 40,000 km. In order to decrease sparking between contacts and lengthen their service life, a small condensor 22 with a capacitance of 0.25-0.35 μf is connected in parallel with the breaker points.

Distribution of the high voltage current is by rotor 25, installed on bushing 33 of the cam and fixed in place by a spring plate in the rotor bushing. The high voltage current from the ignition coil arrives at central terminal 30 and is distributed among terminals 31 of the sprakplug wires through carbon contact 28 and plate 26 in two rotations of the crankshaft. The wires from the sparkplugs are connected to terminals 3) in distributor cap 27 in correspondence to the firing order of the cylinders in the engine (1-5-4-2-6-3-7-8), considering the fact that the rotor turns to the right.

Opening of the breaker points occurs at the moment when the combustible mixture is to be ignited, when the piston in the first cylinder at the end of the compression cycle is at 4° before TDC. Adjustment of the moment of ignition of the mixture as a function of operating conditions and type of fuel used

is achieved by the octane adjuster. By rotating nut 9 by means of lever 6, body 2 carrying hammer 39 is rotated relative to cam 20; the ignition timing angle can be changed within limits of ±10° of crankshaft rotation in this manner.

The spark advance angle is changed with changing load on the engine by means of the vacuum advance system. A tube from the mixing chamber of the carburetor is connected to plug 24. Rarefaction is transmitted through this tube beneath diaphragm 54 in the advance mechanism. As the load on the engine decreases, when the throttle valves are open slightly, the rarefaction increases, and diaphragm 54, overcoming the force of spring 56 rotates moving disk 42 through arm 35, and hammer 39 rotates along with the disk relative to cam 20; this causes the contacts to open earlier and increases the spark advance. As the load increases, the throttle valves open more widely, the rarefaction decreases, causing a decrease in the spark advance.

The vacuum advance mechanism changes the spark advance within limits of 0 to 10.5° as the rarefaction changes from 100 to 280 mm hg.

The spark advance is changed with changing operating speed of the engine by means of the centrifugal advance mechanism, the two weights 13 of which are installed on the driven plate of shaft 1, held together with springs and connected through fingers to traverse 43, which is fastened on cam bushing 33. As the speed of rotation of the engine increases, the weights move apart and rotate traverse 43, together with the cam, in the direction of rotation of the distributor shaft. This causes the contacts to open earlier and the spark advance angle is increased. The centrifugal regulator changes the spark advance angle between 0 and 14.5° as the crankshaft rotation speed is increased from 200 to 1,500 rpm and more.

The design of the type R105 shielded distributor has several differences from that of the R13-V distributor. Its body is made of zinc alloy. In order to suppress radio interference arising as the distributor operates, its plastic cap 27 is covered with metal shield 49 with cover 50, held down by bolts 51. The shield carries two output tubes for the high voltage shielded conductors to the sparkplugs and the contact of the high voltage wire to the coil. The body carries jack 48 for the low voltage wire.

The B13 ignition coil is mounted in a one-piece steel body 61, covered with carbolite cap 73 with oil and gasoline-resistant gasket 87. The body of

the coil carries circular magnetic conductor 62. At the center of the coil is core 64, assembled of 43-38 plates of transformer steel.

In order to decrease heating from vortex currents, the rings of the magnetic circuit and the plates of the core are covered with scale.

The core is enclosed in insulating tube 88, around which secondary winding 65 of copper wire is wound. Primary winding 63 (also of copper wire) is wound above the secondary winding, allowing better cooling of the primary.

The primary and secondary windings, as well as the rows of windings, are isolated by layers of condensor and cable paper; insulating capron resin bushing 70 is placed on top of the core, and the central circular projection of carbolite cap 73 rests on the secondary winding; at the bottom is porcelain insulator 91, between the bottom of the body and the secondary winding. For better insulation of the windings and liberation of heat, they are immersed in transformer oil, poured into the body of the coil; at 20°, the oil level should be 3-5 mm above the ends of the windings. Supplementary resistor 86 is connected in series with the primary winding 63; this resistor is shorted when the engine is started, assuring more reliable ignition of the mixture. Spiral 86 of the supplementary resistor is made of nickel wire, with a resistance of 1.8-1.9 ohms. For cooling purposes, it is directed outward and enclosed in porcelain insulator 85, consisting of two halves. Spiral 86 also acts as a variator; at low engine speeds, due to the increased time which the points spend closed, it becomes heated and its electrical resistance increases, limiting the current in the primary winding and spark formation across the points. The connections of the windings and the lead to the terminals of the coil are shown on the Figure.

The B5-A shielded coil has the following differences. Its carbolite cap 73 is covered by metal one-piece shield 93, rolled onto body 61. Shield 93 carries contact 94 of the high voltage wire and two shielded jacks 95 for leads 92 and 96 of the caps VK and R terminals of the coil. Supplementary resistor SE102 of the shielded coil is located separately from it (beneath the instrument panel of the truck). It is made of constantan wire with an electrical resistance of 1.45-1.55 ohms. This spiral does not act as a variator, since its resistance is constant over a broad range of temperatures.

Sparkplugs. The A11U unit sparkplugs (SN) have the plant marking SN200. The height of heat cone 107 (skirt) of the plug is 11 mm. Body 101 of the plug, made of automatic steel, has a hex nut shape designed to fit a 22 mm wrench; the nominal diameter of the threaded portion of the body is 14 mm. One side electrode 97, made of nickel-manganese steel type NMTs-5 is spot welded to the side of the body. The outer surface of the body is covered with a special anticorrosion composition. The center of the body carries one-piece central electrode 98 of the sparkplug, made of heat-resistant steel; rod 103, welded to this electrode, is made of soft carbon steel. Insulator 105 of the central electrode operates under severe conditions, being subjected to significant heating in the combustion chamber of the engine and cooling in the head, as well as when fresh mixture is fed into the cylinder. To protect it from moisture, the outer surface of the insulator is covered with a glaze. To provide better heat transfer between the skirt of the plug and the body, heat-conducting washer 100 is installed between them. The efficiency of the plug depends to a signifi-

cant extent on its tightness of seal; therefore, the central electrode is fastened to the plug by thermal cement 104, and sealing talc composition 106 is placed between the body and the insulator.

The spark gap between the central and side electrodes should be 0.8-0.9 mm.

The A15B (SN304) plug differs in the following ways. Its skirt height is 15 mm, its insulator is made of high-quality ceramic -- borocorundum. On trucks with shielded electrical equipment, the sparkplugs are covered with a special screen. The central electrode of the plug is a two-piece structure, with a glass-based sealing compound between the contact head and the central electrode within the insulator.

High voltage wires. On some trucks, PVVO wires with high distributed resistance are used in order to decrease radio interference created by the ignition system. When ordinary high voltage wires are used, SE14 damping resistors of 8-13 kilohms are installed on the sparkplugs. Trucks with shielded electrical equipment carry type PVS-7 wire with steel core and rubber insulation, in metal shielded flexible cables.

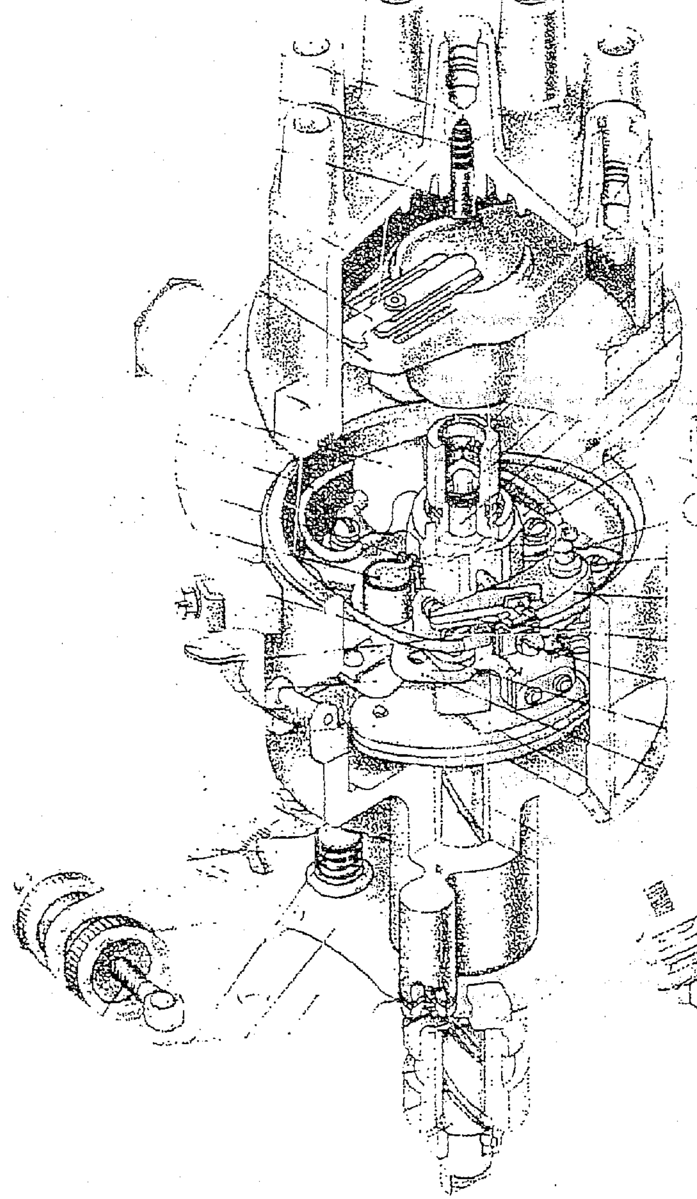
Maintenance. During TO-1, the parts of the distributor must be wiped off, the operation of the lever checked, the sparkplugs cleaned and the mounting of the distributor and sparkplugs checked. During TO-2, remove the sparkplugs, clean them of scale and check the sparkplug gap, check the gap and pressure between the breaker points, place a few drops of motor oil into lubricating packings 19 and 32 and onto shaft 36 of the hammer. Rotate cap oiler 12 by one-half turn, thus feeding some high-temperature lubricant to bushings 3 of shaft 1. Wipe off the coil and wires and check their condition. Tighten the mountings of the ignition devices. Each third TO-2, remove the distributor, check it on a test stand and lubricate it in correspondence with the lubrication card. Ball bearing 53 is lubricated with type TsIATIM-201 high-temperature lubricant each time the distributor is dissembled, at least each 40,000-50,000 km.

The setting of the ignition is tested at each TO-2 cycle, and also if the type of gasoline or operating mode of the vehicle are changed.

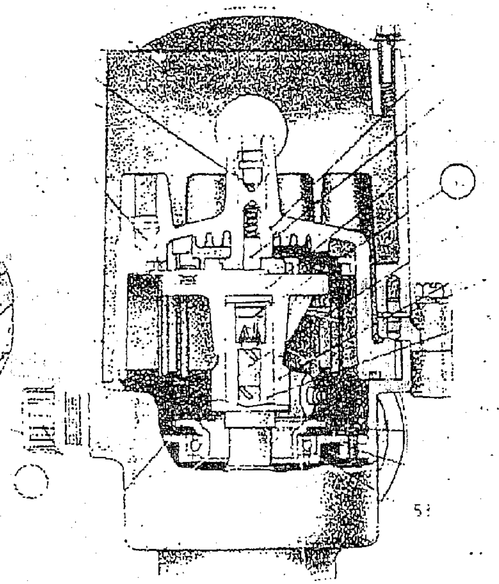
1 - distributor drive shaft
2 - distributor body
3 - drive shaft bushing
4 - ignition setting lever mounting screw
5 - octane adjuster plate
6 - ignition setting lever (octane adjuster plate)
7 - connecting rivet
8 - adjusting screw
9 - octane adjuster regulating nut
10 - octane adjuster indicator arrow
11 - octane adjuster scale on setting plate
12 - oiler for lubrication of drive shaft bushing
13 - centrifugal regulator weight
14 - nonmoving disk of breaker
15 - nonmoving contact upright stop screw
16 - distributor cap mounting bracket spring
17 - low voltage wire terminal
18 - wire connecting primary of coil to breaker lever
19 - lubricating packing of cam
20 - eight-sided breaker cam
21 - wire from condensor to ground
22 - condensor
23 - vacuum advance mechanism body
24 - plug connecting tube from carburetor
25 - distributor rotor
26 - current distributing plate of rotor
27 - distributor cap
28 - carbon contact in distributor cap
29 - carbon contact spring
30 - central terminal for wire from coil
31 - terminal from sparkplug wire
32 - cam bushing lubricating pad
33 - cam bushing
34 - wire connecting condensor to breaker lever
35 - vacuum advance mechanism arm
36 - breaker arm shaft
37 - eccentric adjusting screw
38 - lever spring
39 - breaker lever (hammer)
40 - screw fastening lever spring and wires from condensor and coil
41 - nonmoving contact upright
42 - moving disk of breaker
43 - driven plate (traverse) of centrifugal advance mechanism
44 - aperture to atmosphere
45 - threaded fitting for lubricant input
46 - setting clutch
47 - setting blade on shaft
48 - jack for connection of low voltage wire
49 - shield protecting radio equipment from interference
50 - shield cover
51 - bolt fastening shield to distributor body
52 - wire connecting moving disk of distributor to ground
53 - breaker moving disk ball bearing
54 - vacuum advance mechanism diaphragm
55 - bracket for installation of vacuum advance mechanism
56 - diaphragm spring
57 - vacuum advance mechanism cover
58 - lever bearing
59 - lever contact (hammer)
60 - nonmoving contact (anvil) of breaker
61 - ignition coil body
62 - magnetic conductor of coil ("iron" external)
63 - primary winding of coil
64 - core ("iron" of core)
65 - secondary winding of coil
66 - contact plate at end of secondary winding
67 - coil mounting bracket
68 - output wire of primary of coil
69 - liquid dielectric (transformer oil)
70 - insulation bushing
71 - plate contact spring
72 - "R" terminal for connecting low voltage wire from breaker
73 - coil cover
74 - contact head (tip) of high voltage wire
75 - "VK" terminal connecting high and low voltage winding wires

40 - screw fastening lever spring and wires from condensor and coil
41 - nonmoving contact upright
42 - moving disk of breaker
43 - driven plate (traverse) of centrifugal advance mechanism
44 - aperture to atmosphere
45 - threaded fitting for lubricant input
46 - setting clutch
47 - setting blade on shaft
48 - jack for connection of low voltage wire
49 - shield protecting radio equipment from interference
50 - shield cover
51 - bolt fastening shield to distributor body
52 - wire connecting moving disk of distributor to ground
53 - breaker moving disk ball bearing
54 - vacuum advance mechanism diaphragm
55 - bracket for installation of vacuum advance mechanism
56 - diaphragm spring
57 - vacuum advance mechanism cover
58 - lever bearing
59 - lever contact (hammer)
60 - nonmoving contact (anvil) of breaker
61 - ignition coil body
62 - magnetic conductor of coil ("iron" external)
63 - primary winding of coil
64 - core ("iron" of core)
65 - secondary winding of coil
66 - contact plate at end of secondary winding
67 - coil mounting bracket
68 - output wire of primary of coil
69 - liquid dielectric (transformer oil)
70 - insulation bushing
71 - plate contact spring
72 - "R" terminal for connecting low voltage wire from breaker
73 - coil cover
74 - contact head (tip) of high voltage wire
75 - "VK" terminal connecting high and low voltage winding wires

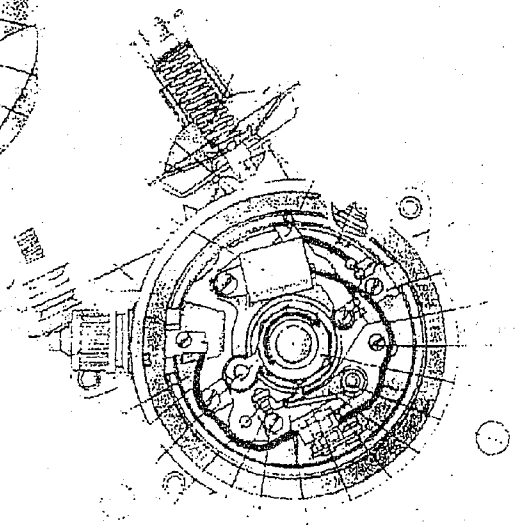
76 - body of SE 01 resistor, acting to decrease radio interference
77 - ceramic resistor rod
78 - rod spring
79 - resistor contact
80 - high voltage wire feeding current from coil to distributor
81 - supplementary resistor bar connected to VK terminal of coil
82 - VK-B terminal of supplementary resistor
83 - high voltage wire contact
84 - supplementary resistor bar connected to VK-B terminal of coil
85 - two-piece porcelain insulator of supplementary resistor
86 - ignition coil supplementary resistor spiral
87 - gasket of oil and gasoline-resistant rubber
88 - insulationg tube
89 - outer insulation of ignition coil secondary winding
90 - outer insulation of ignition coil primary winding
91 - porcelain insulator of secondary coil
92 - lead from VK terminal to plug
93 - metal shield of ignition coil
94 - high voltage wire contact
95 - shielded jack of terminal
96 - lead from R terminal to jack
97 - side electrode of plug
98 - central electrode of plug
99 - sealing ring
100 - heat-conducting washer
101 - plug body
102 - sealing washer
103 - central plug electrode
104 - thermal cement
105 - uralite insulator of central electrode
106 - talc sealing filler
107 - heat cone (skirt) of plug insulator

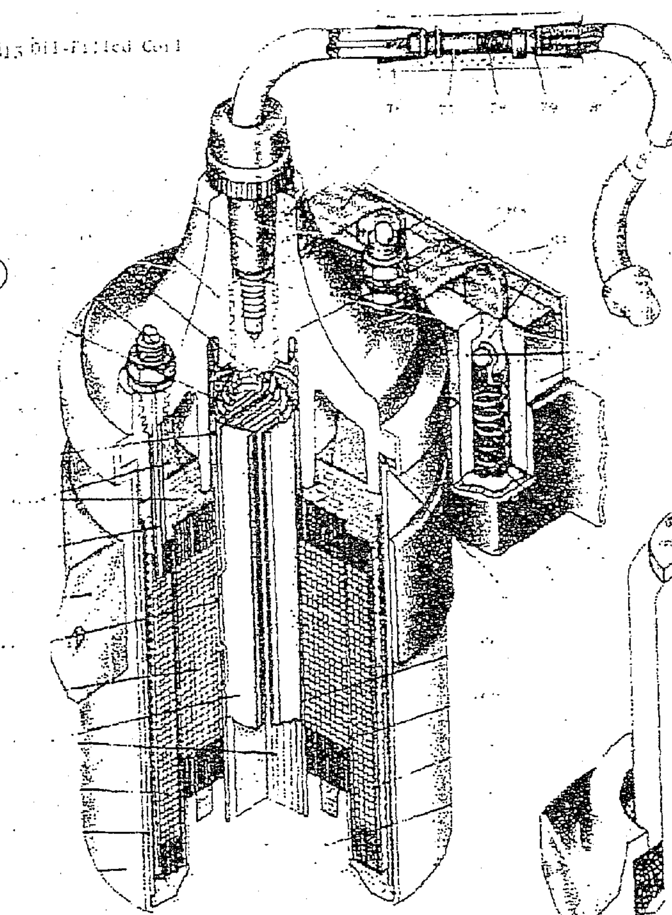


E-5-A2 Distributor

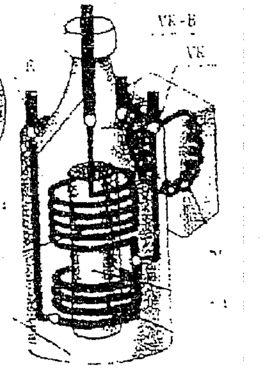


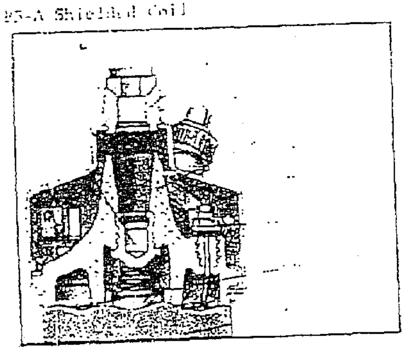
D-5 Distributor



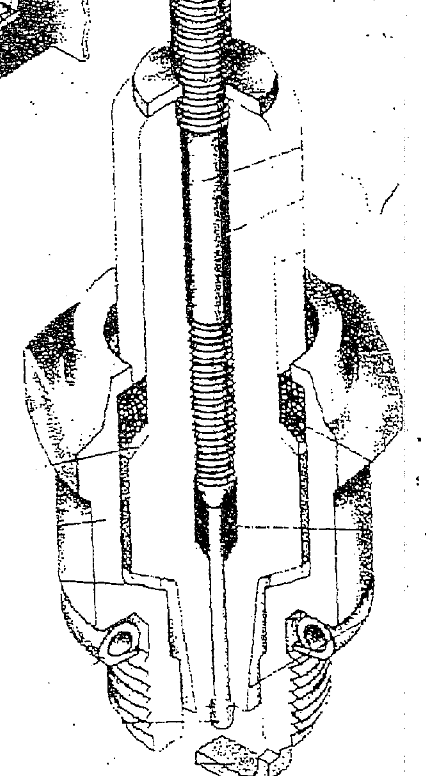


B13 Oil-Filled Coil





R5-A Shielded Coil



A11B Sparkplug

12.6

126-

Basic Data

Nominal power of starter (with 6-ST-68 battery) -- 1.4 hp
Idle mode at 12 v:
current consumed -- not over 60 a
maximum shaft rotation speed -- at least 3,500 rpm
Full braking mode:
current consumed -- 650 a
torque (braking) -- 3 kgm
Number of teeth on starter gear -- 9

Starter and solenoid. The ST130-B starter is a four-pole electric dc motor with series connection of two parallel branches of excitor winding 27. Body 22 of the starter is steel, body 52 of the drive mechanism is made of aluminum alloy. Excitor winding 27 is made of hollow copper wire of rectangular cross section. The terms of the winding are isolated by paper, and the entire coil is wrapped in cotton tape soaked with varnish. The shaft of armature 24 is carried on three copper-graphite, oil-soaked porous bushings 25. The core of the shaft is assembled of thin sheet steel and two (end) insulating plates. The thrity-one slots in the core each carry one turn of the hollor rectangular copper wire. The ends of the turns of the armature winding are soldered to the plates of collector 26. Four copper-graphite-lead brushes 56 and 57 (MGS), installed in box-section brush holders on cover 23 of the starter body are pressed against the collector by spiral plate springs with a force of 1,200-1,500 g. The negative brushes 56 are connected to ground, the positive brushes 57 are insulated from ground and connected to the excitor windings 27.

Starter gear 49 meshes with the gear on the flywheel of the crankshaft of the engine when pulled by a mechanism consisting of a type RS130 solenoid, lever 44 and a free wheeling clutch.

The solenoid has pulling winding 37 and retaining winding 39, consisting of 250 turns each. The puller winding 37 is wound on brass bushing 38, which carries armature 41 of the solenoid. The holder winding 49 is wound above the puller winding. The windings are insulated from each other. The connection of the windings is shown on the Figure. The puller and holder windings are wound in the same direction, so that the magnetic flux of the holder winding strengthens the action of the flux of the puller winding. Return of steel armature 41 to its initial position occurs under the influence of its spring, which has a slot into which a blade on the relay body disk enters to hold the armature and prevent rotation.

At the end of the armature shaft (on the same end as the contact box) contact disk 35 is mounted freely, its skew is compensated by its spring, and adjusting screw 42 is mounted on the armature drive end, connected to lever 44 through plate 43.

The free wheeling clutch allows torque to be transmitted only in one direction, from the starter to the flywheel gear, and automatically stops the

transmission of torque from the engine to the starter after the engine is started. Guiding bushing 47 of the clutch is equipped with quadruple spiral splines and installed on the end of shaft 24, on which there is a quadruple spiral gear. This significantly reduces the force necessary to mesh gear 49 of the starter with gear 51 of the flywheel and allows the size and weight of the solenoid to be decreased, also decreasing the consumption of nonferrous metals for the windings. Driving body 46 of the clutch, with four wedge-shaped slots 59, is mounted rigidly to the end of shaft 47. These slots carry four rollers 48 with pushers 58 and their springs. Rollers 48 move in the narrow portion of the slots 59 under the influence of springs and pushers 58 and wedge between body 46 and the hub of gear 49, transmitting the torque from shaft 24 of the starter through body 46 and the hub to gear 49.

After the engine starts, when the rotating speed of the flywheel exceeds the starter speed, gear 51 of the flywheel becomes the driving gear, and the torque begins to be transmitted from the flywheel to gear 49 of the starter. When this happens, the springs force pushers 58 into slots 59 and body 46 begins to rotate freely, transmitting no torque. Thus, the free wheeling mechanism stops transmission of torque from the motor to the starter, preventing the starter from being spun by the motor.

Supplementary electromagnetic switching relay RS502 switches on the entire electrical circuit of the starter, then switches it off automatically when the engine starts; this eliminates accidental switching on of the starter while the engine is in operation.

A magnetizing winding is wrapped around core 18 of this switch relay. Armature 17 of the relay is held in the open position by spring 19. Silver contacts 16 are soldered to the brass armature plate and upright 14. The tension of the armature spring is adjusted by bending bracket 21 which supports it.

The electrical circuits are switched by rotating the contact rotor of lock 12 in its plastic base; the rotor and base have silver contacts and

terminals. The base of the VK324 lock carry three terminals: the central terminal marked AM and two side terminals marked KZ (ignition coil) and ST (starter). The key to the VK324 lock can be in three positions: 0 -- everything off; I -- switch rotated clockwise, turning on ignition (terminal KZ); II -- switch rotated further (fully), turning on starter (terminal ST). The VK21-K lock has additional terminal Pr, to which a radio receiver can be connected (not supplied with the truck). Terminal Pr is turned on in position I, and also when the key is rotated fully to the left (to fixed position III); in this position, the ignition is off.

Positions 0 and I are fixed by a ball and spring mechanism in the lock, position II is not fixed. The lock rotor is held in the on position by the key. When the driver stops twisting the key, the lock rotor is returned to position I by the lock cylinder spring, automatically disconnecting the starter circuit.

Operation of starter, solenoid and switching relay. When lock 12 is turned on, current from battery 4 travels to the AM terminal of the lock, then through the ST terminal to winding 15 of supplementary relay 4 and from it to the Ya terminals of the voltage regulator 6 and generator 5, through the armature to ground and the negative terminal of battery 4. As current passes through winding 15, magnetized core 18 pulls back armature 17, and contacts 16 close. The current from the positive terminal of battery 4 then passes through the wires to terminal AM on lock 12, terminal B of voltage regulator 6 and body 13 of the relay, then to frame 20 through armature 17 and contacts 16, from terminal S through the wire to the puller winding 37 and holder winding 39 of the starter solenoid. Then the current is branched and follows two paths: from the puller winding 37 to bus 33, to excitor winding 27 of the starter, to collector 26 and the armature and through brushes 56 to ground and through ground to the negative terminal of battery 4; from holder winding 39 to ground and also to the negative terminal of battery 4.

Magnetization of the starter solenoid coils causes its armature 41 to move; lever 44 causes gear 49 of the starter to mesh with gear 51 of the flywheel, and contact disk 35 closes contact bolts 30 and 31 of the solenoid, supplying current to the starter.

The current path through the starter is as follows: from the positive pole of battery 4 through the wires through contacts 30 and 31 and contact disk 35 of the solenoid through lead 29 to the excitor winding 27, further through brushes 57 and collector 26 and through brushes 56 to ground and the negative terminal of battery 4. The movement of lever 44 meshes gear 49 of the starter to gear 51 of the flywheel. The starter begins to rotate the crankshaft of the motor, in order to start it. The current with full braking of the armature (when the starter cannot rotate the crankshaft) reaches 650 a. Extended and frequent use of the starter is quite harmful to the battery. If the ends of the starter gear teeth do not mesh with the teeth on the flywheel, lever 44, continuing to move, will compress buffer spring 53 through clutch 54. When armature 41 closes the starter contacts through contact disk 35, armature shaft 24 rotates and gear 49 will mesh under the influence of buffer spring 53.

When contact disk 35 makes contact, contacts 31 and 30 as well as terminal 32 of the contact plate of the ignition coil are connected. This shorts supplementary resistor 7 of the coil, as well as puller winding 37; the armature is then held in position by holder relay 39.

As the rotating speed of the armature of generator 5 increases as the motor is started, the electromotive force of the generator increases. This causes the magnetic flux in winding 15 to decrease, due to the potential difference of the emf of battery 4 and generator 5. Immediately after starting of the engine, the voltage of generator 5 increases so much that spring 19 retracts armature 17, opening contacts 16 and current no longer flows to winding 37. When this occurs, the return spring causes armature 41 of the starter solenoid to move to the right and disconnect gear 49 through lever 44, and contact disk 35 disconnects contacts 31 and 30; current no longer flows to winding 27 of the starter and it is switched off. The return spring of armature 41 also opens the contacts of the starter solenoid and unmeshes the starter gear if it is wedged or if, due to great discharging of the battery (or if the engine is very cold) the starter cannot rotate the crankshaft.

Checking the technical condition of the starter and care of the starter. The starter gear should mesh freely with the teeth on the flywheel and disconnect automatically after the engine is started.

During TO-1, the starter body is cleaned of oil and dirt, the mounting of the starter to the engine is checked, along with the operation of the switching mechanism, the terminals are cleaned, and the fasteners mounting the wires to the starter, solenoid and supplementary relay and the battery are tightened. If necessary, the starter retaining bolts are tightened.

At every second TO-2, compressed air is blown through the internal cavity of the starter body, the condition of the brushes, collector, switching contact and return spring of the drive mechanism is checked. If the collector becomes dirty and the contacts become burned, they are rubbed with a rag wet with regular gasoline, or if they are quite dirty and burned they are cleaned with sandpaper. The use of emory paper is not permitted. After the starter is cleaned, it is blown out with compressed air. The drive mechanism is washed with kerosene and the bushing of the drive gear is lightly lubricated with the oil used for the engine. If the collector is quite rough, the armature is sent to the shop.

The force of the springs pressing on brushes 56 and 57 should be 800-1,300 g, in a new starter 1,200-1,500 g. The height of the brushes in a

new starter is 14 mm. Brushes which are oil soaked or less than 7 mm high must be replaced.

After being sure that the starter operates properly, it is necessary to check the adjustment of its switching mechanism. The distance between the end of gear 49 and the plane of the flange of the starter body should be 34 ± 1.5 mm. The setting of gear 49 in this position is adjusted by stop screw 45.

The clearance between the end of gear 49 and stop ring 50 with the main contacts closed should be 9 mm, and with the gear engaged -- 2-3 mm. The setting of gear 49 in the engaged position is adjusted by rotating screw 42 in the body of armature 41 with plate 43 disconnected. The moment of connection of supplementary resistor 7 of the coil is determined by connecting an electric bulb in the circuit and adjusted by bending the contact plate of terminal 32. This closure should occur before the main contacts of the solenoid close.

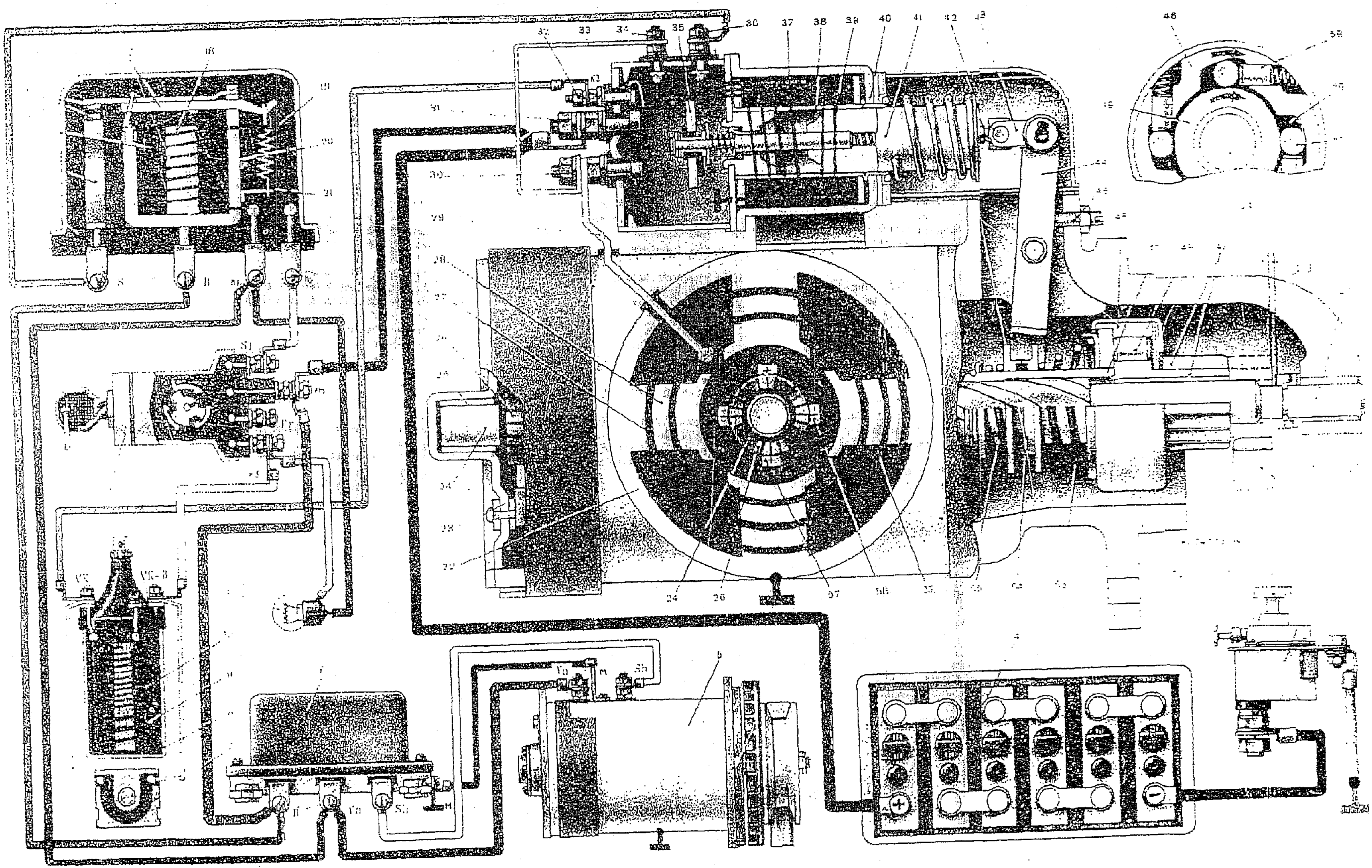
Adjustment of the supplementary relay is tested each third TO-2. The clearance between armature 17 and core 18 should be between 7.0 and 1 mm, which is adjusted by bending the armature travel limitor. The normal clearance between contacts 16 is 0.4-0.6 mm, adjusted by bending upright 14. Closure of the relay contact should occur at a voltage of 4-7 v. The moment of closure is adjusted by changing the tension of spring 19, by bending bracket 21.

During seasonal maintenance, the starter is removed and dissembled. The body, front and rear covers, brushes, armature, collector and switching mechanism are inspected. The contacts are cleaned. The excitor winding and armature are checked. The bearings and journals of the armature shaft are lubricated with the oil used for the engine and the rollers of the driving lever fork are lubricated with grease (UTVMA TsIATIM-201 or UTV 1-13). A-ter assembly, the switching of the starter is checked and adjusted if necessary, the starter is tested in the idle mode and with full braking of the armature.

1 - VK318 ground switch
2 - central contact switching shaft
3 - side lever fixing central shaft
4 - type 6-ST-68EM battery
5 - G130-V two-pole direct current generator
6 - RR130 three-element voltage regulator
7 - supplementary resistor of coil
8 - body of B13 coil
9 - primary winding of coil
10 - secondary winding of coil
11 - battery discharge warning light
12 - VK21-K ignition and starter switch (lock)
13 - body of starter supplementary switching relay (SSR) RS502
31 - battery contact bolt
32 - coil contact plate terminal
33 - connecting bus
34 - terminal connecting puller winding to excitor winding of starter
35 - contact disk
36 - terminal connecting puller and holder windings to switching relay
37 - puller winding
38 - brass bushing of armature
39 - holder winding
40 - body of RS130 electromagnetic starter solenoid
41 - armature of starter solenoid
42 - armature adjusting screw

14 - upright of SSR nonmoving contact
15 - magnetizing winding of SSR
16 - SSR contacts
17 - SSR armature
18 - SSR core
19 - armature spring
20 - SSR frame
21 - spring bracket
22 - body of ST130-B starter
23 - cover of body
24 - starter armature shaft
25 - porous bearing bushing soaked with oil (3)
26 - starter armature winding collector
27 - series excitor winding
28 - pole shoe
29 - starter excitor winding lead
30 - excitor winding contact bolt

43 - lever drive plate
44 - starter gear switching lever
45 - lever travel adjusting screw
46 - driving body of free wheeling clutch
47 - clutch guide bushing
48 - free wheeling clutch roller
49 - drive gear with driven hub
50 - gear thrust wheel
51 - gear (flywheel)
52 - drive body
53 - free wheeling clutch buffer spring
54 - clutch
55 - limitor spring (switching clutch spring)
56 - negative brush connected to ground
57 - positive brush connected to excitor winding
58 - roller pusher
59 - wedge-shaped slot



7A

133

133-a

Lights and Signaling Devices

To assure safety in driving the truck, it is equipped with lights for illumination of the road, marking of dimensions and signaling turns and braking. The road in front of the truck is illuminated with headlights 33, type FG 122-B and the supplementary spotlight, type FG 16-V.

Body 13 of the headlight contains an optical element consisting of reflector 4, push-in two-filament bulb 3 with socket 17 and jack 11 and glass lens 2. Reflector 4 is made of cold-rolled steel. A thin layer of aluminum is sputtered onto its surface in a vacuum, after preliminary covering of this surface with varnish, producing an absolutely smooth mirror surface. The aluminum coating reflects more blue light and less yellow light than a silver coating, making headlights with aluminum reflectors seem brighter. The glass envelope of bulb 3 contains high beam filament 29, at the point of focus of the reflector and low beam filament 28, above and to the left of the optical axis of the reflector. Screen 30 is placed in front of the high beam filament, reducing the blinding effect of the light. The envelope of bulb 3 is filled with the inert gas krypton, causing the tungsten filaments to evaporate less and produce more light.

The position of the bulb in the headlight and, consequently, the position of the filaments, is strictly focused, for which purpose there is a special notch on the flange at the projection of collar 1.

Lens 2 is made of colorless, transparent glass. On the inside of the lens is an optical system consisting of a large number of prisms and lenses which, together with screen 30 of the bulb, cause the high beam light to be distributed unevenly, primarily along the right side of the road.

When driving in fog, the light beams from ordinary headlights are reflected from the fog droplets, creating a light curtain in front of the moving vehicle and blinding the drivers of oncoming vehicles. For use under severe road conditions, the truck may carry additional special fog lights, placed below the main headlights illuminating the lower, thinner layers of fog and improving illumination of the road.

The fog lights also use a lens with special ribs, and beneath the bulb there is a special additional reflector, increasing the scattering of the light and improving illumination of the edges of the road. Also, some fog lights use yellow lenses, since yellow light penetrates fog best.

The spotlight is used to illuminate individual sectors of the road and objects on either side. The ball mount of the spotlight allows it to be rotated by 360° in the horizontal plane and within limits of ±36° in the vertical plane.

Parking lights 31 and tail lights 59 and 66 are used to mark the dimensions of the truck and to signal turns and stops. Bulb 58 of the left tail light also illuminates the license plate.

Steel stamped body 31 of the parking light carries an insulation panel with two-contact pin jack for bulb 32. A 6 cd filament is included as a marker light, plus a 21 cd filament in the circuit of turn signal switch 62, used to signal turns.

The lenses of the parking lights should be white.

The body of the FP 101-B right tail light is divided by a horizontal barrier into two independent compartments. The upper compartment contains type A 26 single-filament bulb 60, with a filament of 21 cd. This lamp is mounted in a single-contact pin socket on the insulating panel. It serves as the brake light and flashes to act as the turn signal. The lower compartment carries single-filament bulb 67, a type A 24 with a 3 cd filament. This bulb is used as a marker light, and in left tail light FP 101 it also illuminates the license plate. The lens installed in the body of the tail light is made of red transparent plastic. This lens has a system of prisms and lenses on the inside which reflect the light from the bulb to the following

vehicles. Thus, it also acts as a dimensional marker light.

The front and rear turn signals should be visible over 15° in the vertical plane, 80° in the horizontal plane in the direction of the turn and 45° in the opposite direction. The external lights and signals should be switched on together, for which purpose the truck carries central light switch 55, foot dimmer switch 56, turn signal switch 62 and electromagnetic interruptor 34. The low and high beams of the headlights, as well as the turn signals, should switch on at the same time as the rear marker lights and the license plate light. The same is true of the fog lights. The dimensional markers should switch on simultaneously front and rear and illuminate the license plate.

The front turn signals flash together with the rear turn signals and dashboard signal light 65.

When the lever of turn signal switch 62 is put in the position for a right turn, the following contacts are closed: 6 (from the power supply), 2 (from the right front turn signal) and 5 (from the right tail light). Current pulses are transmitted through interruptor 34 to the right front and rear lights, signaling the turn. At the same time, terminal 3 of hydraulic switch 51 of the top signal is connected to terminal 4 of the left tail light, which comes on if the brakes are applied.

When the lever of switch 62 is put in the position for a left turn, the following contacts are closed: 6, 1 (from the left parking light) and 4. This causes the left front and rear lights to blink, signaling the turn. At the same time, terminal 3 is connected to terminal 5, and the right tail light is used to signal braking.

Maintenance. The condition of the insulation of wires, their mountings and proper operation of the lighting system are checked during TO-2. At the same time, the condition of the lights is checked and they are adjusted. Dust is removed from the lenses through the aperture in bushing 1 (after removal of bulb 3) with moist cotton, after which the lights are dried. Bulbs with dark envelopes are changed, without waiting until they burn out.

If the lenses crack, it is replaced installed with the point marked "top" upward. The voltage drop in the headlight circuit as in the circuits of the other lights should be checked periodically, and should not be over 0.6 v.

To check the alignment of the headlights, the truck is set on a horizontal area 7.5 m from a screen on a wall. The truck should be unloaded. The headlights are adjusted in turn, by rotating the optical element of the headlight in body 13 by means of two adjusting screws 8 (vertical and horizontal) and seeing that the light is directed below the geometric axis of the headlight and matches the light spot drawn on the test screen. The height of the horizontal axis of the spot should be 1,000 mm, the distance of the vertical axes of the centers of the light spots from the headlights from the central axial line of the truck should be 775 mm.

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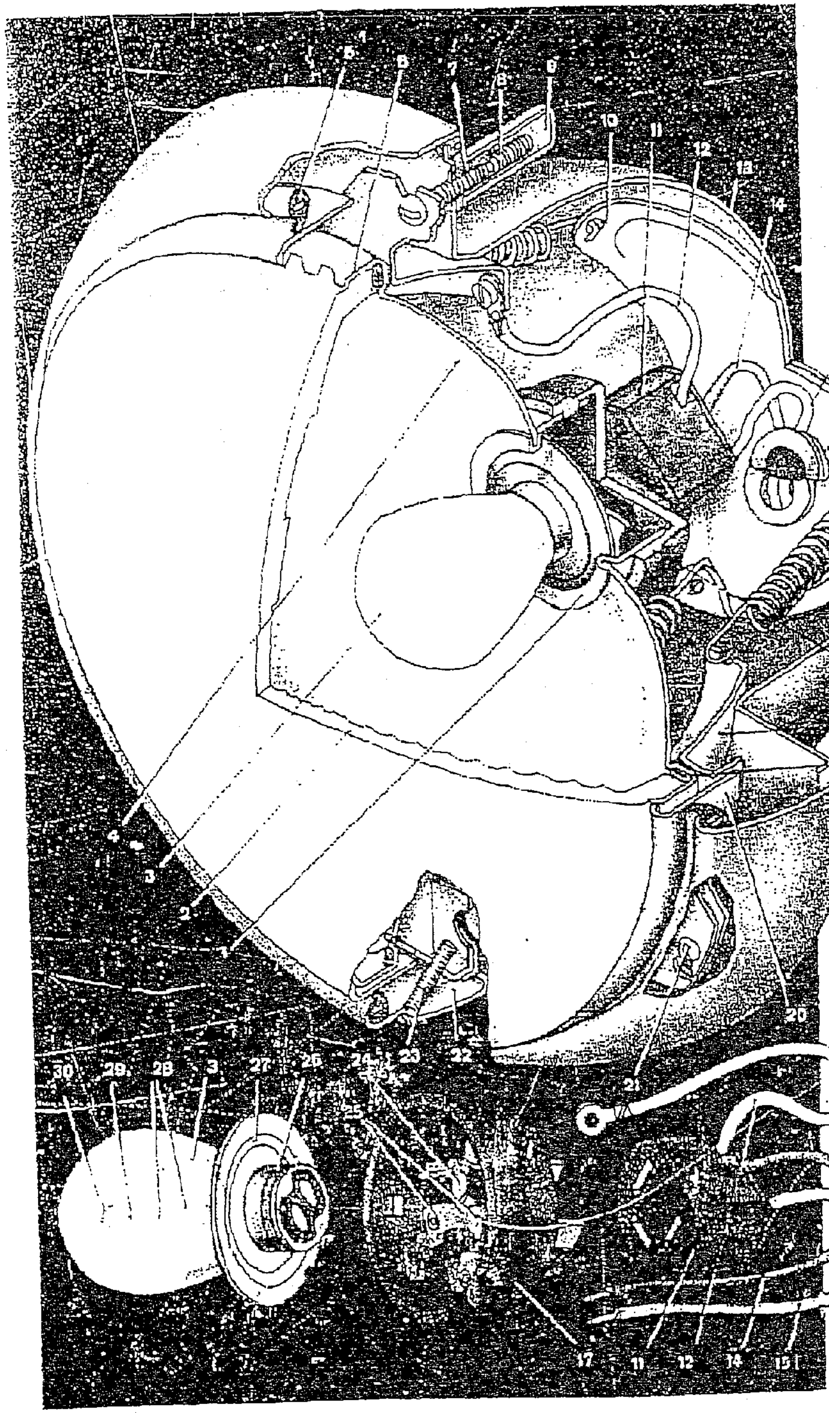
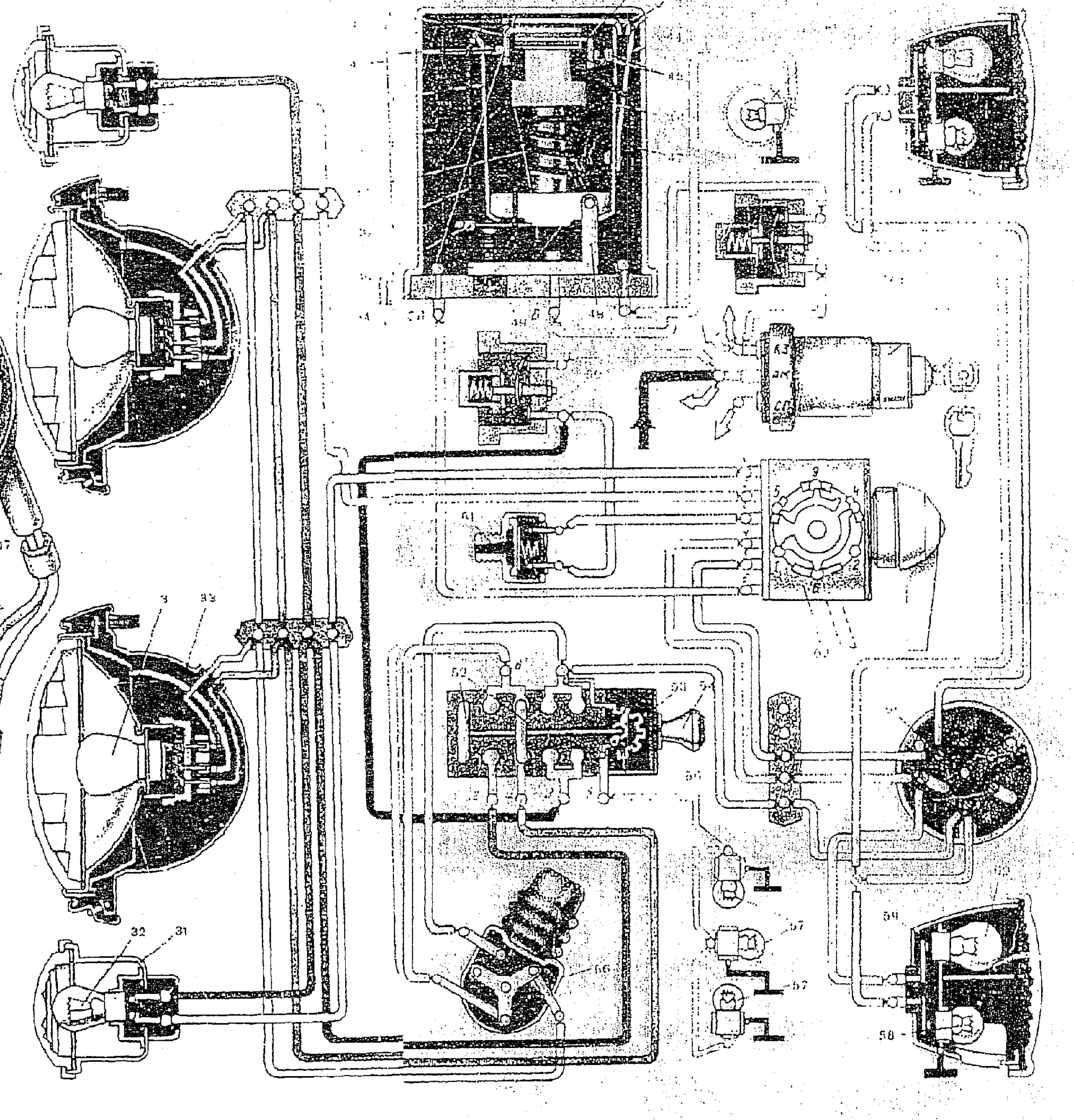
Bulbs burn out and failures occur in the illumination and signal system if the voltage regulator is improperly adjusted (when the voltage is too high) or in case of short circuits (causing bimetallic button fuses 50 and 64 to blow). The fuse should be switched back on only after the problem has been located and eliminated.

1 - bushing carrying flanged bulb base
2 - headlight lens with asymmetrical distribution of light
3 - two-filament electric bulb type $A\frac{12-50}{12-40}$ (high beam 50 w, low beam 40 w)
4 - light reflector
5 - sealing ring
6 - teeth on reflector for mounting of lens
7 - capron self-locking nut on adjusting screw
8 - headlight adjusting screw
9 - adjusting device protective cap
10 - headlight mounting bracket spring
11 - jack
12 - line connecting bulb to ground
13 - light body
14 - high beam wire
15 - low beam wire
16 - headlight suspension spring
17 - bulb socket
18 - headlight installation ring (holder)
19 - lens sealing ring
20 - headlight installation rim
21 - installation rim mounting screw
22 - headlight body rim
23 - headlight body rim mounting screw
24 - ground contact
25 - low and high beam contacts
26 - bulb base
27 - bulb base flange
28 - low beam filament
29 - high beam filament
30 - screen reflecting light from high beam filament
31 - parking light PF 101
32 - A 27 bulb (12 v, 21 + 6 cd) for turn signal and marker light
33 - type FG122-B headlight with $A\frac{12-50}{12-40}$ bulb
34 - electromagnetic turn signal interruptor
35 - glass bushing (bead) insulating line
36 - nichrome contact braker line
37 - winding of interruptor electromagnet
38 - supplementary resistor (18 ohms)
39 - armature of electromagnetic turn signal interruptor
40 - silver contacts of turn signal interruptor
41 - nonmoving angle piece of turn signal contact interruptor
42 - angle piece of nonmoving contact of turn signal indicator light
43 - armature and spring stops
44 - flat bronze armature spring
45 - silver contacts of indicator light interruptor
46 - armature of electromagnetic indicator light interruptor
47 - bus feeding current to indicator lamp
48 - base bracket
49 - adjusting screw
50 - bimetallic PR2-B (20 a) button fuse for lights
51 - VK12 hydraulic stop signal switch
52 - shaft contact plate
53 - rheostat for adjustment of brightness of instrument panel lights
54 - switch shaft
55 - P38-B central light switch
56 - P39 foot switch
57 - instrument panel lights
58 - A24 bulb (12 v, 3 cd) illuminating license plate and marking dimensions of truck
59 - left tail light type FP101
60 - A26 bulb (12 v, 21 cd) for turn signal and brake light
61 - trailer jack
62 - P 118 turn signal switch
63 - ignition switch (lock)
64 - PR315 (15 a) bimetallic button fuse for turn signals and heater fans
65 - turn signal indicator bulb
66 - FP101-B right tail light
67 - A24 bulb (12 v, 3 cd), dimensional marker





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The Clutch

Basic Data

Type -- dry, single-plate, with damper.
Driven plate diameter -- 300 mm.

Design and operation. The clutch of the truck is installed in a cast aluminum housing 1, the bottom of which is closed by stamped casing 2. The main parts of the clutch include: the pressure plate with its cover and pressure springs, the release mechanism and the driven plate with its damper.

Stamped cover 23 of the clutch is fastened to flywheel 19 by six centrifugal bolts. The cover has three rectangular apertures, into which the fitted projections of cast iron pressure plate 22 fit, assuring proper installation of the pressure plate relative to the clutch cover, flywheel and, consequently, crankshaft of the engine. These projections transmit the torque from the flywheel through the cover to the clutch pressure disk.

Between the clutch cover and pressure disk are 12 pressure springs 24, which clamp the driven disk of the clutch between the pressure disk and the flywheel. Therefore, when the clutch is engaged, the two disks rotate together. Hub 29 of the driven disk is se[illegible]d on the splines of drive shaft 31 of the transmission, and the torque of the engine is transmitted to the transmission through these splines.

The clutch mechanism consists of three release levers 35, collars 47 with the thrust bearing, clutch forks 3 and the drive system.

The release levers are connected by means of pins 39 and 40 and needle bearings 41 to the pressure disk of the clutch and mounting forks 38, also articulated to the clutch cover with special spherical adjusting nuts 45. This connection of the forks to the cover is necessary, since the forks rotate relative to the cover slightly as the clutch is operated.

When the clutch pedal is depressed, the hydraulic clutch drive acts on the outer end of fork 3, moving it backward; the inner end of the fork then presses on collar 47, moving it in the direction toward the flywheel. The end of the bearing on the collar rests against the ends of release lever 35 which, rotating on the axes of forks 38 and overcoming the force of the pressure springs, move the pressure plate away from the driven plate, disengaging the clutch.

When the pedal is released, the inner end of the fork and collar are pressed backward by the force of the springs and the clutch is engaged.

The thrust bearing is lubricated through oiler 43, fastened to the bracket in the upper portion of the crankcase and connected to the clutch by flexible hose 46.

In order to prevent overheating of the pressure springs when the clutch is slipped as it is engaged, heat insulating washer 25 of pressed asbestos fiber are placed between the springs and the pressure plate.

The clutch pressure plate and cover are statically balanced after assembly; balance is achieved by drilling metal out of the pressure plate lugs. The imbalance must not exceed 36 gcm.

Driven plate 21 of the clutch consists of a steel disk, six spring plates 26 and two friction liners 20 of asbesto-bakelite material, one of which is fastened to the steel disk, the other to plates 26 on the opposite side of the steel disk. When the clutch is engaged, as the pressure on the driven plate increases, these plates are gradually straightened and, when the clutch is fully engaged, they become flat. This causes the torque transmitted to increase gradually, allowing the clutch to be engaged smoothly.

The damping device of the clutch prevents it from transmitting torque oscillations and improves the smoothness of engagement. The main parts of the damper are: eight springs 36, placed in the apertures in hub 29 of the driven plate 21 and plates 27 of the damper, and two washers 30 of friction material, compressed with a predetermined force between the disk and plate of the damper. The force on the washers is selected by means of adjusting steel shims 34 (placed beneath the friction washers) so that the friction which arises as the disk and plates of the damper move relative to the hub is between 2 and 2.5 kgm.

Angular displacement of the driven plate relative to its hub is limited by four pins 28 which rest in the edges of the hub flange notches when the movement reaches its maximum.

The driven plate is statically balanced after assembly by installation of balancing weights. The permissible imbalance of the driven plate is 18 gcm.

Adjustment and replacement of parts. When the clutch is engaged, identical clearance should be maintained between the heads of the levers and the end of the thrust bearing, 2 mm. Variations in clearance cause the pressure plate to skew when the clutch is disengaged, and result in abnormal operation of the clutch (incomplete disengagement or engagement, vibrations). Evenness of the clearance is adjusted by loosening or tightening nut 45; when adjustment is completed, the nuts are locked. The position of the lever heads is adjusted only at the plant or when the clutch is being repaired. During operation, this adjustment should not be required. The main parts of the clutch which must be replaced or repaired during operation include the clutch disengagement bearing, the driven and pressure plates.

To remove the plates, remove the transmission and lower portion of the case. Then remove the clutch cover and flywheel mounting bolts; they should be loosened gradually (in several passes) in order to avoid bending the supporting lugs on the cover or damaging the threads on the bolts.

The clutch plates, when separated from the flywheel, can be withdrawn from the casing only in the proper position, since the second frame cross member partially covers the lower hatch of the clutch case. First, the pressure disk should be removed, by turning it with one of the lugs of the cover downward and lifting the driven plate, then the driven plate is removed.

In case of wear or damage to the friction liners of the driven disk, the liners must be replaced. New liners should be riveted on so that the heads of the rivets are at least 1.5 mm below the liner surface. The variation in height of friction surfaces of the liners should be not over 0.7 mm, measured at a radius of 125 mm from the center of the plate.

If the surface of the pressure plate is found to be warped, scratched, to have deep circular channels or cracks, the plate must be replaced or repaired by turning and grinding.

When the pressure plate is dissembled, the marks on the cover and plate must be followed to assure that these parts retain their initial position and, consequently, their balance.

The thickness of the plate following repair should differ from the thickness of a new plate by not over 1.5 mm. The difference in distances from each axis of the three apertures for the lever shafts to the worked plate surface should not be over 0.15 mm, and the surface should be flat (a 0.05 mm feeler gauge should not pass beneath the plate lying on a flat surface).

When the cover is being re-assembled with a repaired pressure disk, metal shims must be inserted with the heat insulating washers of the proper thickness to compensate for any decrease in the thickness of the plate.

After this, the position of the ends of the clutch levers should be adjusted, using the flywheel and the new driven plate for this purpose. To perform the adjustment, place the driven disk and assembled pressure disk with cover on the friction surface of the flywheel; tighten the cover mounting bolts to the flywheel. Then, using adjustment nuts 45 of the release levers,

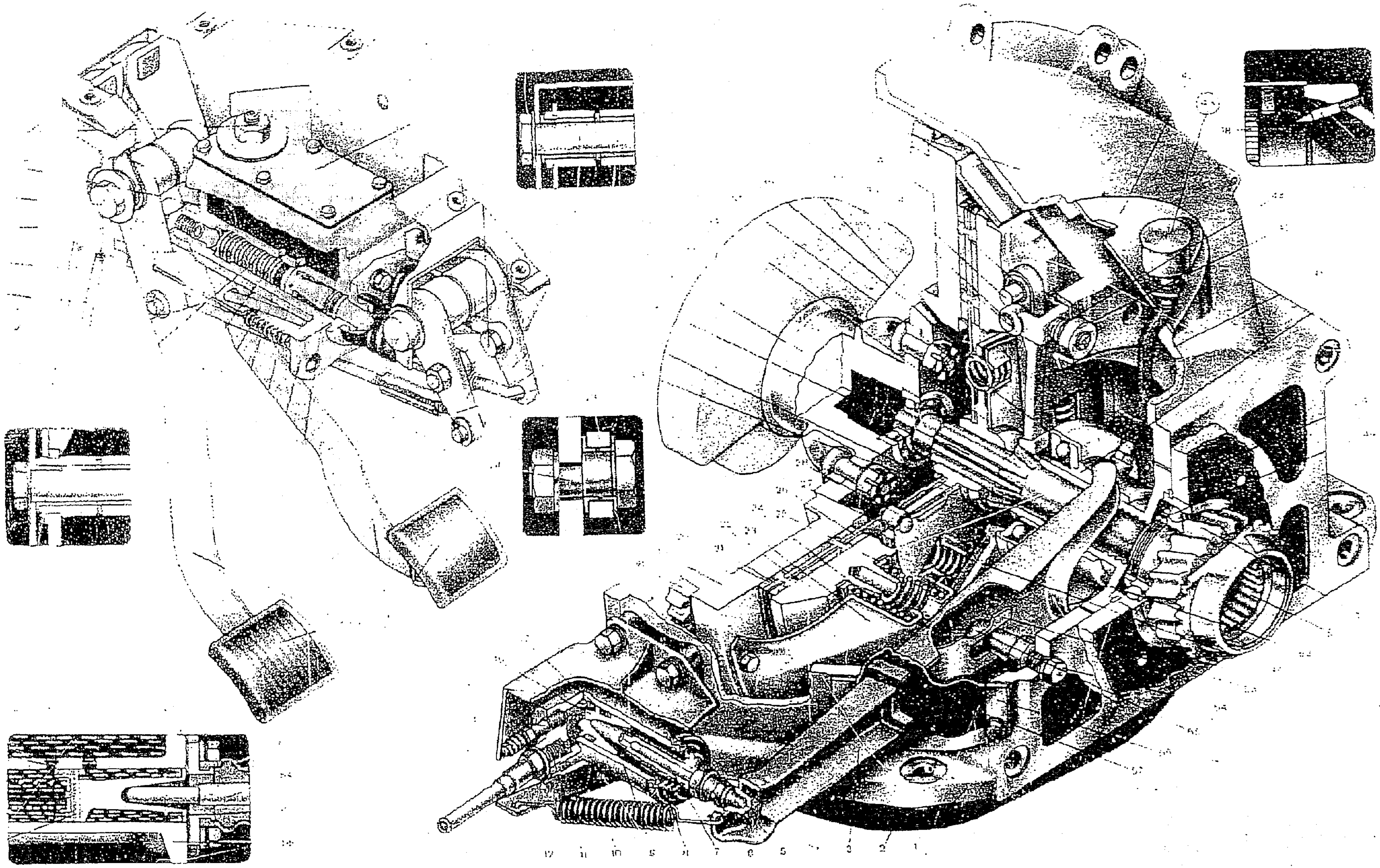
adjust the distance from the surface of the flywheel to the end of the levers to 54 ± 0.25 mm, and make sure the deviation of the ends of the levers from this surface is not over 0.3 mm; after this, lock the adjustment nuts.

Care for the clutch consists of lubrication of the clutch collar and its thrust bearing during TO-1; type 1-13 grease, GOST 1631-61, should be used. One full filling of cap oiler 43 is required.

If lubrication is more frequent or abundant, the excess lubricant may reach the clutch plates. If the bearing is lubricated less frequently, the lubricant may thicken in the apertures feeding it from the circular cavity of the collar to the bearing.

If the hose feeding the lubricant to the thrust bearing has been removed or broken, it must be refilled with lubricant when replaced. Two lubricant forcing cycles from the full cap oiler are required to fill and empty hose 46, after which the cap oiler should be refilled once more.

1 - clutch housing
2 - bottom case
3 - clutch fork
4 - thrust fitting of clutch fork
5 - adjustable clutch fork pusher
6 - pusher counter nut
7 - pusher tip
8 - protective rubber cap of cylinder
9 - hydraulic clutch drive cylinder
10 - fork return spring
11 - hydraulic drive hose nipple
12 - hydraulic drive hose from main cylinder
13 - valve cap
14 - valve for pumping out clutch hydraulic drive system
15 - heat insulating shield on hydraulic clutch drive cylinder
16 - piston
17 - piston sealing ring
18 - flywheel gear (148 teeth)
19 - flywheel
20 - driven plate friction liner
21 - clutch driven plate
22 - clutch pressure plate
23 - clutch cover
24 - driven plate spring (12)
25 - heat insulating washer on spring
26 - spring plate (6) fastening rear friction liner to driven disk
27 - torsional damper plate
28 - driven disk thrust pin
29 - driven disk hub
30 - asbestos friction washers of oscillation damper
31 - driving (primary) shaft of transmission
32 - engine crankshaft
33 - crankshaft counter weight
34 - steel adjusting shim (installed during assembly of oscillation damper)
35 - pressure plate release lever (3)
36 - torsional oscillation damper spring (8)
37 - channel in flywheel for excess lubricant drain
38 - release lever mounting fork
39 - mounting fork pin
40 - pressure plate finger
41 - release lever needle roller bearing
42 - upper cover (with ventilation slits) of clutch casing hatch
43 - clutch release bearing oiler
44 - conical spring of release lever fork moving mount
45 - spherical adjusting nut of fork mount
46 - flexible hose from cap oiler
47 - clutch release collar with ball thrust bearing
48 - transmission case
49 - driving shaft rear bearing nut
50 - constant mesh gear of transmission
51 - needle bearing of driven (secondary) shaft of transmission
52 - bearing cover of driving (primary) shaft of transmission
53 - release fork retaining plate
54 - hinge bolt
55 - release fork hinge
56 - release fork cover frame
57 - release fork cover
58 - main clutch cylinder
59 - piston
60 - compensation hole
61 - internal sealing collar of piston
62 - adjustable break drive arm
63 - main cylinder bypass aperture
64 - piston return spring
65 - clutch drive adjustable arm
66 - brake line
67 - clutch line
68 - clutch and brake pedal bracket
69 - clutch and brake pedal shaft
70 - master cylinder reservoir
71 - filling plug
72 - master cylinder case cover
73 - master brake cylinder piston pusher
74 - eccentric axis of piston pusher
75 - brake drive lever
76 - rod of adjustable brake drive arm
77 - clutch drive lever
78 - rod of adjustable clutch arm
79 - rod counter nut
80 - axis of levers driving brake and clutch
81 - protective cap of clutch master cylinder
82 - brake pedal
83 - clutch pedal
84 - master brake cylinder piston pusher
85 - piston sealing ring
86 - piston bypass aperture
87 - brake and clutch master cylinder cover
88 - polyamide bushing, requiring no lubrication
89 - setting of pin



Drive Train

Basic Data

Drive train -- open type with three shafts.
Shaft length (in assembled state): front and rear shafts 1,046 mm each, intermediate shaft -- 550 mm (length measured between centers of univeral joints).
Outer diameter of shaft tubes -- 75.2 mm.
Diameter of universal joint cross pin -- 22 mm.

Structure. The drive train of the vehicle consists of three drive shafts: intermediate shaft 39, front shaft 21 and rear shaft 42. Each drive shaft has a moving spline connections and two universal joints with needle bearings.

The drive shaft is a thinwall tube, one end of which is pressed and welded onto the universal joint fork, the other end of which mates with splined bushing 24. The splined bushing includes slipping fork 25. These forks must be set in the bushing so that the lugs for the universal joint crosses are in the same plane on both ends of the shaft.

The drive shafts require splined joints because the distance between the devices which they connect on the truck do not remain constant during installation and during driving of the truck.

To protect the splined joint from dirt and to retain lubrication in the splines, a special gland is used, consisting of internal rubber ring 28 and external felt ring 29, separated by steel washers 27. The sealing rings and washers are installed in stamped collar 26 with notches around its outer diameter.

At the ends of the drive shafts are the universal joints, identical in design and dimensions. The flanges of the joints are connected by four bolts each to the flanges of the shafts from the transmission, transfer box and differentials. The universal joints allow a maximum angle of operation from the central axis of 21° in each direction. The joint consists of cross 1 and two forks. The apertures of the fork contain needle bearings, within which the pins of the crosses ride. The bearings are held in the forks by covers 2, fastened to the forks by bolts which are blocked against rotation by plates 3. Each bearing has 26 needles 3 mm in diameter, held in the bearing cup by washer 3 and retainer 15, pressed onto the cup. The rollers are selected in sets and should not be replaced or substituted from other bearings.

The clearance between the ends of the cross and the bottoms of cups 14 of the needle bearings is very slight, so that the crosses are centered in the forks and cannot move along the axes of the pins. The pins of the cross have seals to prevent entry of dirt, dust and water and retain lubrication, consisting of plug glands 16. The bearings are lubricated through press oiler 18. The oil travels through the apertures inside the cross pins and through the channels at the end to the bearings, lubricating the ends of the cross pins at the same time. At the center of the cross is valve 35, which opens when the oil pressure in the system reaches a gauge pressure of 1-3.5 kg/cm^2. As the joints are lubricated, the excess oil passes through the valve, preventing penetration of the plug glands. The cavity of the sliding spline joint of the intermediate drive shaft is hermetically sealed. At the plant,

lubricant is placed in this cavity, providing for reliable operation of the splined joint for 25,000 km, after which it must be replaced.

The front and rear drive shafts differ from the intermediate shaft in length and in the presence of an additional protective device for the universal joints at the differentials. The joints next to the differentials are enclosed in stamped steel spherical caps, protecting the joints from water and dirt thrown out by the wheels of other vehicles.

The internal caps are installed between the flanges of the joints and the flanges of the differentials and held down by the bolts of these flanges. The external caps are fastened by bolts to stamped flanges 19, welded to the drive shaft tubes. On vehicles manufactured up to 1967, the outer protective caps were fastened to the tubes of the drive shafts with two collars retained by nuts and bolts; the lugs of the collars fit into slots in stop plates welded to the shaft tubes.

In order to assure even rotation of the shafts of those parts of the truck interconnected by the drive shafts, it is necessary that the axes of the bearing fittings in the welded and slipping forks of the drive shafts be in the same plane (permissible deviation not over 2°). Therefore, if the drive train is dissembled, when the sliding fork is re-assembled, it must be set so that arrows 32 on the splined and slipping bushings are aligned.

The drive shafts are dynamically balanced together with the universal joints during manufacture. The imbalance (not over 50 gcm) is eliminated by welding of metal plates 22 onto the ends of the tubes.

The most frequently encountered defect in the drive train is excessive clearance in universal joints, resulting from excessive wear of crosses or damage to needle bearings. To eliminate the defect, the joint should be dissembled. If the cross pins have dents from the rollers, the cross should be replaced, or still better, the cross and bearings should both be replaced. The needle bearings should not be dissembled. In case of breakage of rollers or a failure of a bearing, they should be replaced with new bearings. Needle bearings with even one roller missing are unuseable and should not be installed on the truck.

When needle bearings or crosses are replaced, new plug glands should be placed on the cross pins. It should be noted that the plug glands on the cross must be carefully watched. Significant "shrinkage" of plug glands or losses of elasticity, as well as breakage of glands can lead to leakage of lubricant through them. In this case, the glands should be replaced by new glands, since if oil leaks from the needle bearings or if dust or dirt enters the bearings, the cross pins and bearings will rapidly fail.

<u>Maintenance</u>. During TO-1, check the tightness of the drive shaft flange bolts, tighten the protective cap mounting bolts, check the tightness of the glands in the splined joints, lubricant the universal joints.

To lurbicate the universal joints, remove the outer cap mounting bolts, move the cap along the drive tube and lubricate the joint. The needle bearings of the universal joints should be lubricated only with type TAp-10 transmission

oil (winter) or type TAp-15 transmission oil (summer), GOST 8412-57. Greases (such as type US universal medium grease) must not be used.

During TO-2 maintenance, all TO-1 operations must be performed, plus checking the tightness of the fitting of the transfer box, transmission and differential flanges (in case of a loose fit, tighten nuts), and the univer-

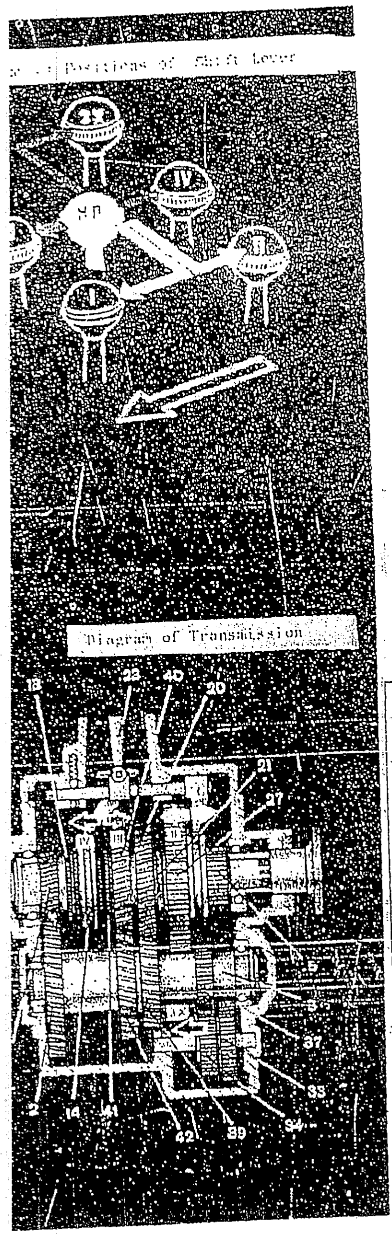
sal joints must be checked for axial and angular play.

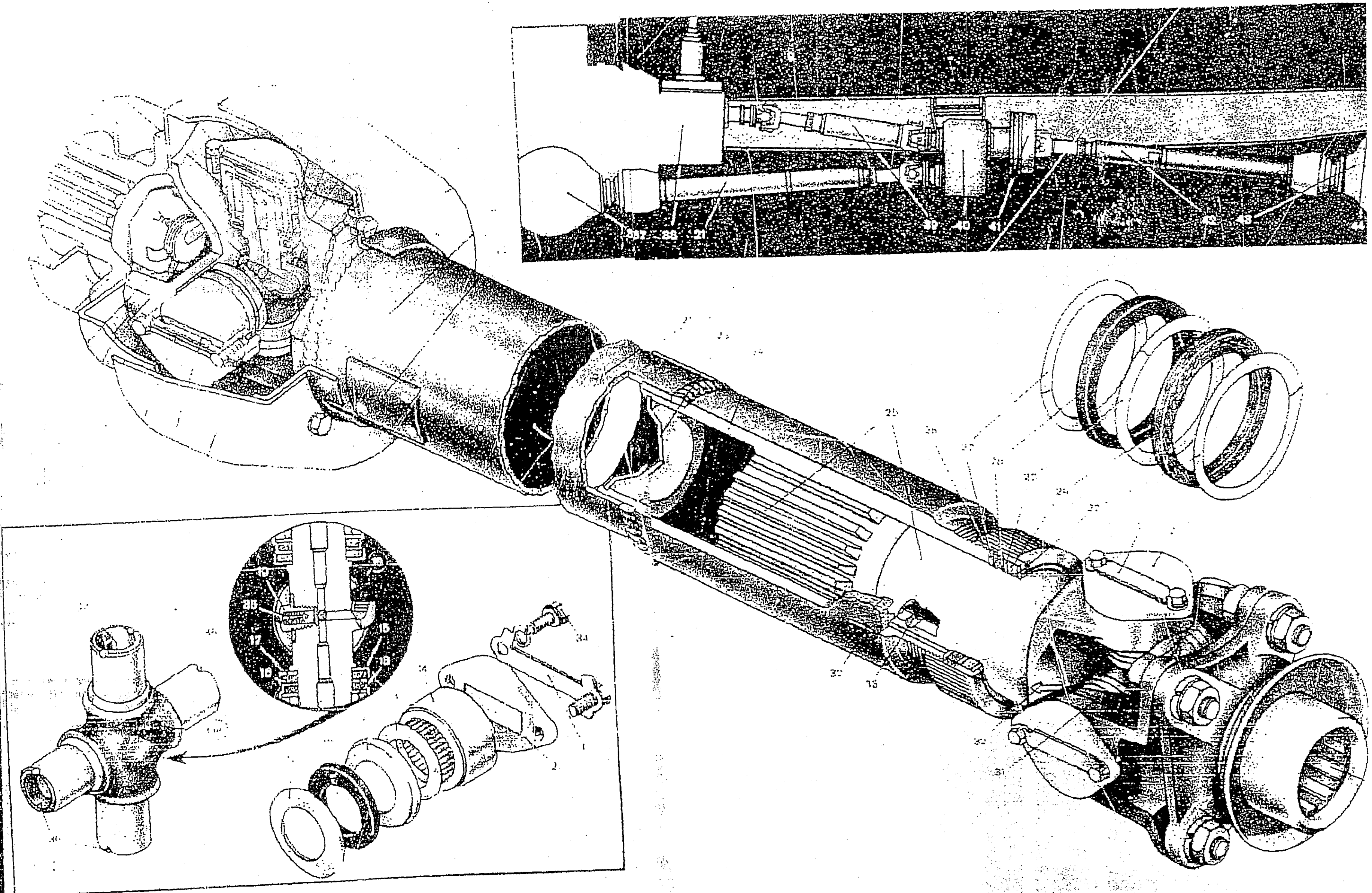
After 25,000 km, remove the drive shafts from the truck and lubricate the splined joints with 1-13 lubricant, GOST1631-68.

The following should be done: unscrew the clamp around the gland; disconnect the splined joint; wash the spline of the sliding fork and the splined bushing cavity in kerosene; distribute 250 g lubricant evenly around the splines of the bushing and in the cavity of the sliding fork; set the fork in the splined bushing, matching the marks on the fork and bushing; tighten the gland clamp, after equalizing the position of the gland rings in the clamp (the clamp should be turned down hand tight).

During operation of the truck, pay attention to the mounting of the needle bearings of the universal joint and tightness of the drive shaft connecting flange mounting bolts. Any clearance in the flanges causes rapid widening of the holes in the flanges or breakage of the bolts.

1 - universal joint cross
2 - needle bearing cup cover
3 - stop plate of cover
4 - outer protective cover
5 - inner protective cover
6 - driving flange
7 - main transmission driving gear flange
8 - driving gear reflector
9 - driving gear of main transmission of front axle
10 - safety valve body
11 - cross bearing needle
12 - channel for transmission of lubricant to cross
13 - needle bearing support washer
14 - needle bearing cup
15 - needle bearing gland holder
16 - needle bearing plug gland
17 - needle bearing gland holder cap
18 - universal joint oiler
19 - flange of outer protective cap
20 - drive shaft fork
21 - front drive shaft
22 - balancing plate
23 - drive shaft plug
24 - drive shaft splined hub
25 - drive shaft sliding splined fork
26 - sliding fork gland clamp
27 - gland washers
28 - rubber gland
29 - felt gland
30 - transfer box shaft flange
31 - drive shaft flange lugs
32 - installation arrow (mark) for assembly
33 - aperture connecting cavities of sliding fork and splined hub
34 - stop plate mounting bolt
35 - safety valve
36 - notch in cross end for transmission of lubricant to bearing
37 - front driving axle
38 - transmission
39 - intermediate drive shaft
40 - transfer box
41 - central (hand) brake
42 - rear drive shaft
43 - rear driving axle
44 - truck longitudinal frame member





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156-a

Basic Data

Type -- hydraulic
Total transfer ratio of drive (without fork) -- 6.75:1
Main cylinder diameter -- 22 mm
Operating cylinder diameter -- 24 mm
Free pedal travel -- 30-37 mm

Design and operation. The hydraulic clutch drive operates through a suspended pedal, arm, drive lever, master cylinder, operating cylinder and hydraulic lines. The master cylinder is the same type used on the M-21 "Volga" automobile.

For the GAZ-66 truck, which has a cab which tilts for servicing of the engine and other units, a hydraulic clutch drive is simpler than a mechanical drive. Furthermore, it eliminates the influence of movements of the motor on its elastic mounts on the clutch, since there is no rigid mechanical coupling between the clutch, installed on the motor, and the pedal fastened to the cabin. The hydraulic drive also allows smoother engagement of the clutch due to the increased time required for movement when the pedal is released, resulting from the hydraulic resistance of the fluid moving through the lines.

The hydraulic fluid used is type GTZh-22 brake fluid (TU MKhP 3759-53), which operates satisfactorily under high and low temperature conditions (its boiling point is +155°, freezing point -65°).

Clutch pedal 1, together with the brake pedal, master cylinder 15, levers, arms and bracket 2 makes up a separate unit fastened to the cabin of the truck with 12 bolts.

The clutch pedal is suspended on shaft 6, which carries a plastic bushing requiring no lubrication. The pedal is retained in its inner most position by return spring 5; in this position, the upper end of the pedal rests against a special stop through rubber bumper 7.

Arm 3 of the clutch pedal is connected to lever 19, freely seated on shaft 21. A nonlubricated plastic bushing is inserted in the aperture in the lever. Master cylinder pusher 14 is connected to the lever by means of adjusting eccentric bolt 20.

Two plastic bushings are seated onto the eccentric bolt, also requiring no lubrication.

Eccentric bolt 20 is used to adjust the clearance between pusher 14 and piston 11 of the master cylinder. With the bolt in the central position, the "0" mark on its head is up.

The travel of the pedal is limited by drive lever 19, the upper end of which rests against a stop in its bracket.

Master cylinder 15 of the clutch drive mechanism is made as a part of a single casting with the brake master cylinder; the two cylinders have a common reservoir for the brake fluid. The lower portion of the reservoir is divided by a rib into two parts; therefore, a defect in one system (brake or clutch) has no influence on the operation of the other. The reservoir is closed with a cover which contains an aperture for filling, closed by a plug. Threaded tip 10 of the plug is used to connect the pump hose when hydraulic fluid is pumped through the clutch drive system.

The master cylinder contains piston 11 with internal sealing ring 8 and external sealing ring 13. Between the piston and internal sealing ring is a thin (0.22 mm) steel washer, preventing the rubber from the inner sealing ring from entering the bypass apertures in the head of the piston. The piston return spring constantly presses against the piston and rings, holding them in their rear most position, limited by master cylinder cap 16.

The cylinder is connected with the fluid reservoir through two apertures. Aperture 9 (0.7 mm diameter) is the bypass aperture, connecting the reservoir with the working portion of the cylinder. Aperture 12 (6 mm diameter) is a compensation aperture, connecting the reservoir with the nonworking portion of the cylinder, contained between the internal and external sealing collars. To protect the inner portion of the cylinder from entry of dust and dirt, a rubber boot is placed over the pusher. Master cylinder 15 is connected to operating cylinder 51 by hydraulic line 4, consisting of three metal tubes and two flexible hoses.

Operating cylinder 51 is fastened to the clutch casing with two bolts. The body of the operating cylinder contains piston 52 with sealing collar 53 and a stop ring. In order to remove air from the hydraulic drive system

(during bleeding) the operating cylinder is equipped with a bypass valve, protected from dirt by a rubber cap. Pusher 46, which can be adjusted in length, is included between the depression in piston 52 and fork pusher fitting 45. Return spring 50 constantly presses the clutch fork, pusher and piston of the operating cylinder forward.

The internal cavity of the operating cylinder is protected from water, dirt and dust by rubber boot 49. To prevent overheating of the cylinder and the fluid contained in it by the exhaust pipe of the engine and the muffler, a heat shield is installed on the cylinder.

When the clutch pedal is depressed, the force is transmitted through arm 3 and lever 19 to the pusher and master cylinder piston. The piston, moving forward, covers bypass aperture 9 and, as it continues to move, forces the fluid into operating cylinder 51, thus creating pressure in the system.

The fluid pressure causes piston 52 of the operating cylinder to act through its pusher on fork 39, rotating it around its ball mount 41. The inner end of the fork moves collar 37 forward, eliminating the clearance between the end of thrust bearing 36 and the heads of the release levers 30, then rotating the release levers relative to pin 32 of supporting fork 34.

When the pedal is released, piston 11 of master cylinder 15 is rapidly returned to its initial (rear most) position by the spring. Due to the resistance of the hydraulic lines, the fluid from the operating cylinder cannot fill the rapidly increasing volume in the working cavity of the main cylinder, as a result of which a rarefaction is created in this cavity. This rarefaction draws fluid from the reservoir through compensating aperture 12 and through the aperture in the head of the piston into the working cavity of the cylinder, pressing the steel washer and the edge of internal sealing ring 8 away. Spring 43 in the clutch and the drive mechanism cause all parts to return to their initial position -- the clutch is engaged. The excess fluid in the operating cavity of the main cylinder, resulting from the arrival of the fluid from the operating cylinder, flows back into the reservoir of the master cylinder through bypass aperture 9.

Adjustment. As friction liners 26 of the main plate wear, the distance between pressure plate 27 and flywheel 24 decreases, causing the heads of the inner ends of release levers 30 to move back, toward thrust bearing 36. When the liners are greatly worn, the levers may rest against the bearing, causing it to operate constantly and be damaged, and also causing the clutch to slip, increasing the wear of the linings or making them useless.

Normal operation of the clutch requires that the clearance between the heads of the release levers and the thrust bearing be 2 mm, the clearance between pusher 14 and piston 11 of the master cylinder -- 0.5-1.5 mm. The total of these clearances determines the free travel of clutch pedal 1, which should be 30-37 mm.

In adjusting the clutch drive, first the clearance between the pusher and piston of the master cylinder must be adjusted. The normal clearance corresponds to 3.5-10 mm of free travel of the clutch pedal. It is adjusted with eccentric bolt 20. After adjustment, the nut on the bolt must be

tightened firmly. If the eccentric bolt is insufficient to provide the required free clutch pedal travel, course adjustment should be first performed by changing the length of arm 3. It is recommended that the return spring be disconnected from the pedal during this process.

The clearance between the thrust bearing of the clutch and the heads of the release levers 30 should be 2 mm, which is adjusted by changing the length of pusher 46 of the operating cylinder. This clearance corresponds to a free travel of the end of the clutch fork of 3.5 mm.

Normal operation of the clutch also requires that the travel of piston 52 of the operating cylinder be at least 23 mm. If the travel is less, the clutch may not disengage completely. Reduced travel indicates that there is air in the hydraulic drive system; if this happens, the system must be bled.

This is done by removing the rubber protective boot from the head of the bypass channel of the operating cylinder and placing a hose on the head. The end of the hose is lowered into a glass vessel, into which some brake fluid has been poured, then the valve is opened by 1/2-3/4 turn. After connecting a tire pump hose to threaded connection 10 of the master cylinder plug, slight pressure is created in the system. This pressure will cause the liquid from the master cylinder reservoir to fill the system, forcing air out through the bypass valve of the operating cylinder. Air bubbles will then rise through the liquid in the glass vessel.

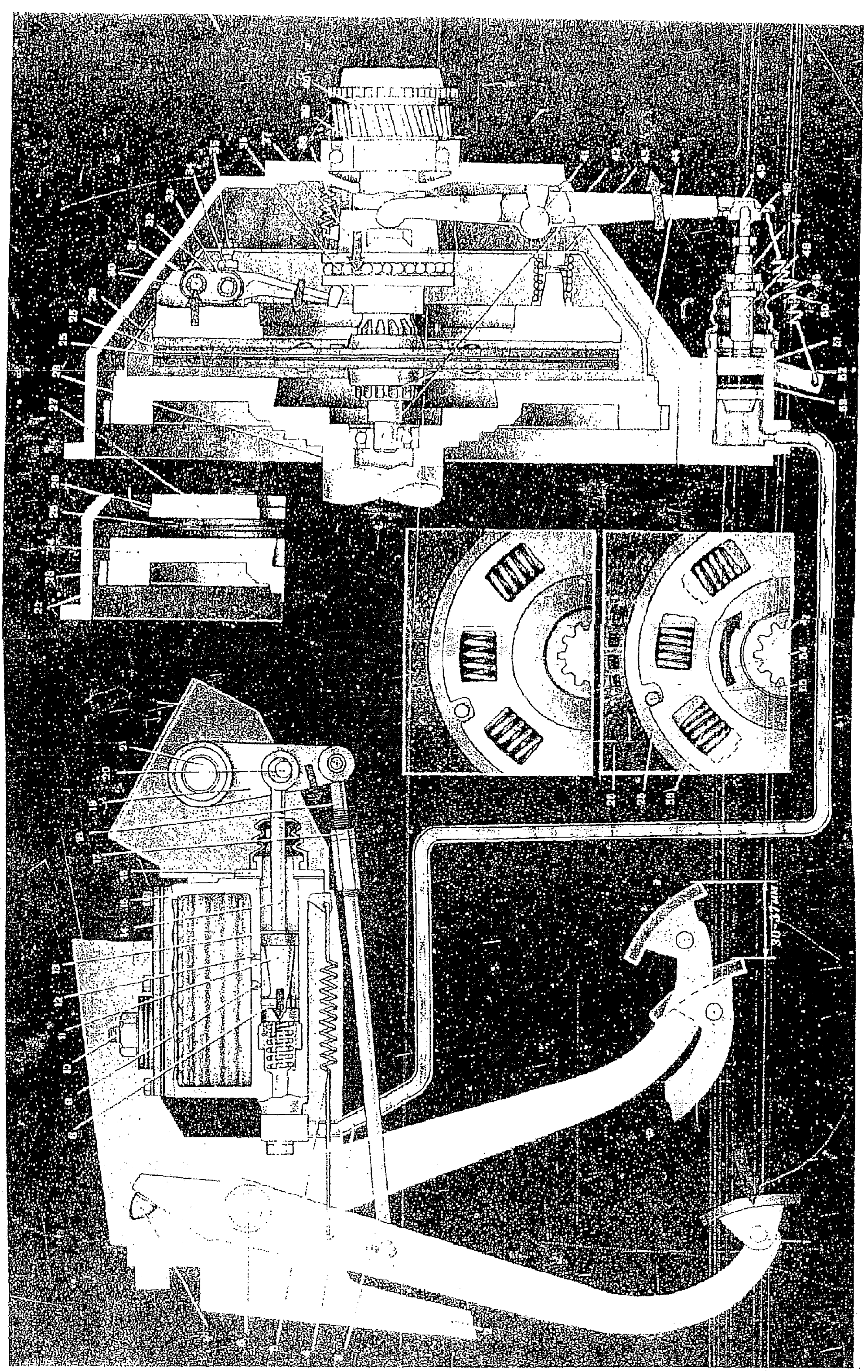
After air ceases to escape from the system (bubbles stop rising from bleed hose), the valve is turned tight, the hose is removed, the protective boot is returned to the bypass valve cap and, after removing the master cylinder plug, fluid is added until the fluid level is 15-20 mm below the upper edge of the filler hole; the plug is then tightened.

After bleeding, the clutch pedal should be pressed down to the floor and the travel of the operating cylinder pusher measured. This travel should be at least 23 mm. If the travel is less, bleeding must be continued until air is completely removed from the system.

Servicing. Care of the clutch drive consists in checking the condition of the drive, adjustment of the free travel of the pedal, testing of the level of the fluid in the master cylinder. All this is done during TO-1.

Particular attention must be given to care of the clutch drive, since GTZh-22 fluid is used, which has strong oxidative properties. Every second TO-1, the fluid should be removed and filtered. During TO-2 (but at least each six months), the fluid should be changed, washing through the clutch drive system and brake system and lubricating the parts of the operating cylinder with a thin layer of castor oil.

1 - clutch pedal
2 - clutch and brake pedal bracket
3 - adjustable clutch drive arm
4 - clutch drive line
5 - clutch drive pedal return spring
6 - clutch and brake pedal shaft
7 - clutch pedal rubber bumper
8 - inner sealing collar of piston
9 - master cylinder bypass aperture
10 - threaded tip in plug cap of master cylinder reservoir
11 - master cylinder piston
12 - master cylinder compensation aperture
13 - outer sealing collar of master cylinder piston
14 - master cylimder piston pusher
15 - clutch master cylinder
16 - master cylinder cover
17 - clutch arm counter nut
18 - clutch arm rod
19 - clutch drive lever
20 - piston pusher eccentric bolt
21 - clutch and brake drive lever shaft
22 - clutch case
23 - flywheel gear
24 - flywheel
25 - clutch driven plate
26 - clutch driven plate friction liner
27 - clutch pressure plate
28 - engine crankshaft
29 - clutch cover aperture
30 - pressure plate release lever
31 - pressure plate finger
32 - bearing fork finger
33 - needle bearing
34 - release lever bearing fork
35 - spherical adjustment nut mounting bearing fork
36 - clutch ball thrust bearing
37 - clutch release collar
38 - release collar spring
39 - clutch release fork
40 - constant mesh gear of transmission (made as one piece unit with drive shaft)
41 - release fork ball bearing
42 - driving shaft of transmission
43 - pressure plate spring
44 - clutch cover
45 - clutch fork thrust pin
46 - clutch fork adjustable pusher
47 - counter nut of pusher
48 - tip of pusher
49 - protective rubber cap of operati[ng] cylinder of hydraulic drive
50 - fork return spring
51 - clutch operating cylinder
52 - piston of operating cylinder
53 - piston sealing collar
54 - driven plate hub
55 - driven plate thrust pin
56 - torsional oscillation damper spring



Transmission

Basic Data

Type -- mechanical four speed
Transfer ratios: first gear -- 6.48:1
second gear -- 3.09:1
third gear -- 1.7:1
fourth gear -- 1.0:1
Reverse -- 7.9:1
Oil capacity of gear case -- 3 l (trucks with winch -- 4.2 l)
Weight -- 56 kg

The transmission. The primary design features of the transmission are the use of constant meshing of gears for second, third and fourth gear, as well as synchronization of third and fourth gears. Furthermore, in order to reduce the noise level of the transmission, its constant mesh gears are spiral cut. Driving shaft 18 is installed on two bearings: the front bearing is mounted in a seat in the engine crankshaft, the rear bearing is mounted in the front wall of transmission case 1.

At the rear end of the driving shaft is a cone and two gear wheels: one gear 4, spiral cut, meshes constantly with large gear wheel 2 on the intermediate shaft, while straight cut gear 13 meshes with synchronizer clutch 14 when fourth gear (direct) is engaged.

A similar straight-cut gear 41 and cone are mounted on third gear 40; the conical surfaces of these gears are fitted at the plant with blocking rings 12 and installed as a set.

Driven shaft 5 rides on two bearings: a cylindrical roller bearing in the driving shaft seat and a ball bearing in the rear wall of the transmission case.

The rear end of the shaft, beyond the ball bearing, carries a spacer bushing nut, flange 32 of the universal joint and a washer. The nut is locked, using a slot in the shaft.

The middle portion of the shaft carries splines, on which sliding driven gear 27, for first gear, rides. Second gear 29 is freely seated on the smooth neck of the secondary shaft; this gear has two gear wheels: one spiral-cut gear, constantly in mesh with the corresponding gear of the intermediate shaft, and one straight-cut gear 21, which meshes with gear 27 when second gear is engaged.

The front end of the driven shaft carries the following items, held in place by a nut: synchronizer hub 11, steel spacer bushing 15 and a thrust disk.

Intermediate shaft 3, a unit of four gears, rotates on a cylindrical roller and a ball bearing.

Gear 37 is straight cut, meshes with gear 27 when first gear is engaged and with the large gear of unit 33 when reverse is engaged. The axial and radial apertures in the rear portion of the intermediate shaft are used for technological purposes.

The reverse gears 33 and 34, equipped with a bronze bushing, rotate freely on shaft 35. This shaft has a slot which improves the conditions of lubrication on the bronze bushing. The shaft is installed using the marks on its end and on the case.

Dirt trap 46 is installed in the case to hold wear products and dirt which settles out of the transmission oil.

A gland is installed in the rear cover of the transmission case to prevent oil leakage. Furthermore, an oil-wiping spiral channel is cut into the inner surface of the rear cover. This channel, contacting the driven shaft flange, forces oil away from the gland. A similar oil-wiping channel is cut on the inner surface of the driving shaft cover.

Control. The transmission is shifted by rocking lever 23. The lower end of the lever fits into slots on the forks and shifter heads on the gear shafts.

The ball mount of the lever is located in stamped cap 25 and pressed against its spherical surface by a conical spring.

The gears are shifted by three shafts mounted in the top cover; these shafts carry the gear forks and shifting heads. The shafts are held in their various positions for the various gears and neutral by balls 18, which fit into depressions on the shafts and are pressed against them by springs.

There is a lock to prevent simultaneous engagement of two gears. When the middle shaft moves, plungers 52 enter channels in the outer shafts and block them. When an outer shaft is moved, the plunger, moving out of its channel, blocks the middle shaft and, pressing through the pin of lock 51 onto the other plunger, blocks the other outer shaft.

In order to push the shift lever into the position corresponding to reverse, it is necessary to overcome the additional resistance of spring 50, located in the shifter head of the reverse gear. This makes it more difficult to engage reverse accidentally while driving forward.

Synchronizer. To allow easy, crunch-free engagement of third and fourth gears, the transmission includes an inertial type synchronizer, allowing each gear to be engaged only after the speeds of the driven shaft and the shaft of the gear being engaged have equalized. This results in silent shifting.

Hub 11 of the synchronizer is splined to the driven shaft. Its outer surface carries teeth, over which clutch 14 slides as the gears are shifted, and three slots, evenly spaced around the circumference, for steel stamped thrust plates 47, pressed against the clutch by two springs 48. The circular channel on the outer surface of the clutch carries the third and fourth gear shifting forks. During movement, the clutch shifting forks, together with the thrust plates, move along the teeth of the hub.

Blocking ring 12 is equipped with a straight-cut gear, which meshes with the teeth of the clutch as the transmission is shifted. The ends of the teeth of the blocking ring turned toward the clutch are beveled. On the end of the blocking ring toward the hub there are three slots evenly spaced around the circumference, into which the ends of the thrust plates fit. All thrust plates are both in the slot in the hub and in the slot in the blocking ring. The slots in the blocking ring are wider than on the hub by approximately one-half of the spacing of the teeth on the gears to be meshed.

When the transmission is shifted, blocking ring 12, moved by thrust plates 47, presses against the cone on the driven shaft or third gear and, due to friction, rotates by the clearance between the thrust plate and the slot in the blocking ring. When this happens, the teeth of the synchronizer collar are moved opposite the teeth of the blocking ring, and the transmission cannot be shifted until the speeds of the parts to be meshed are equalized. When the speeds of the parts are equalized, the teeth of the synchronizer collar, passing between the teeth of the blocking ring, mesh with the teeth of the corresponding gear.

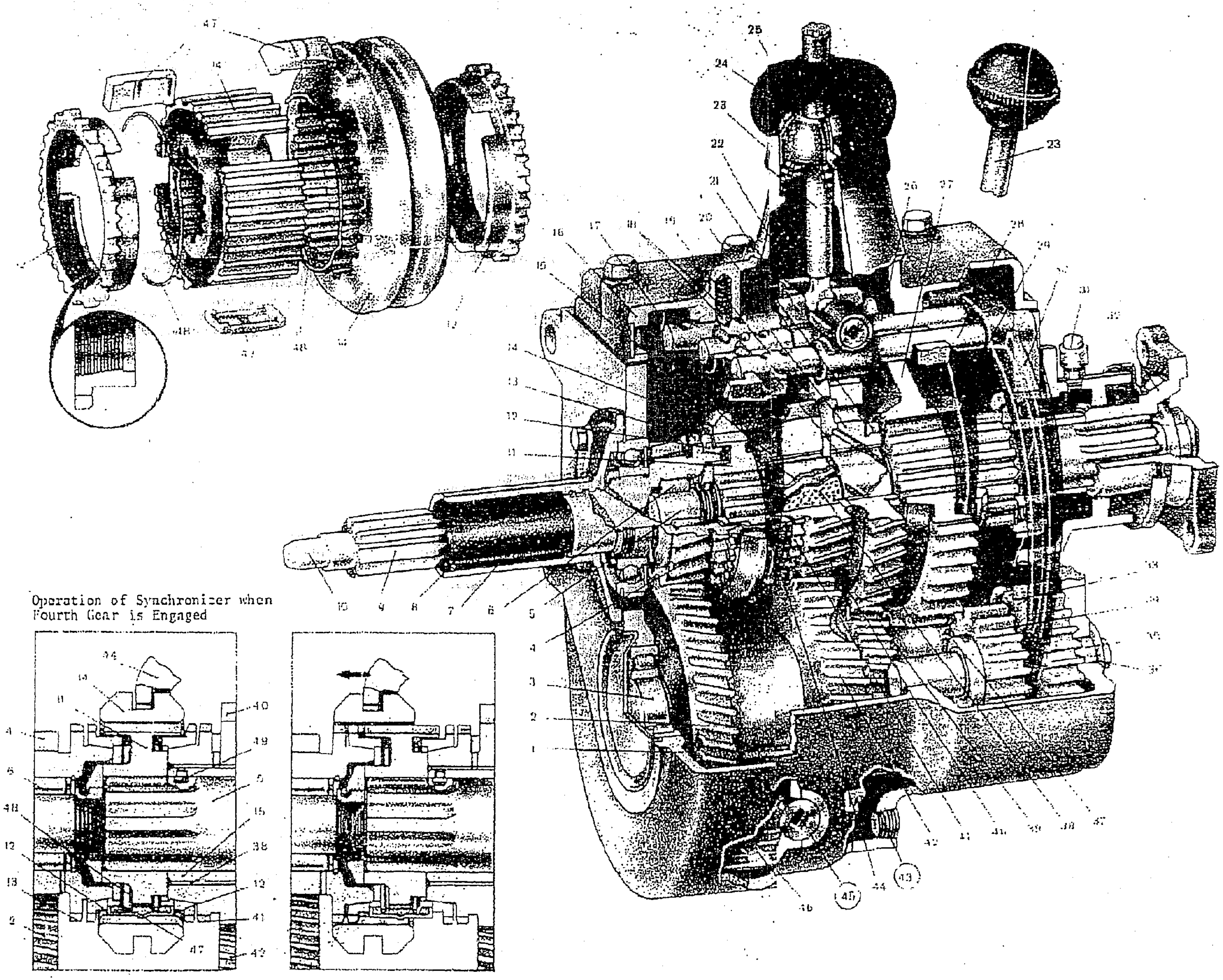
Servicing. During TO-1, check the level of oil in the transmission, determined using the test hole with plug 45. During TO-2, check the reliability of the mounting of the transmission to the clutch, be sure that there are no leaks through the glands and gaskets.

Each second TO-2, change the oil in the transmission. The oil is drained through the aperture in the bottom of the case, covered with plug 43, and filled through the hole in the top cover of the transmission (after removing the shift lever). The transmission is lubricated using type TAp-10 (winter) and TAp-15 (summer) oil, GOST 8412-57.

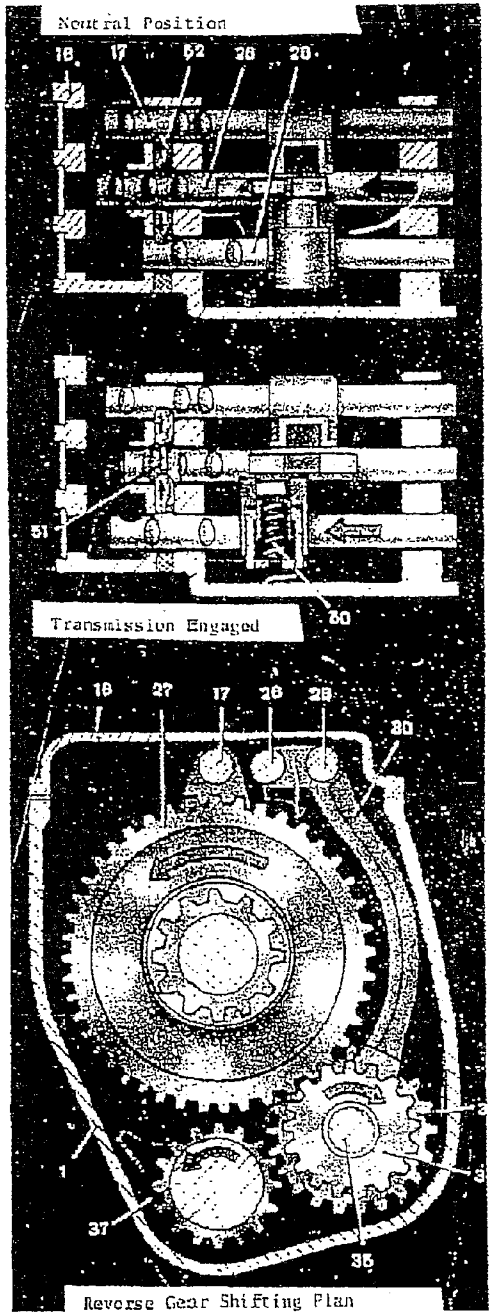
1 - transmission case
2 - driven gear (41 teeth), constant mesh
3 - intermediate shaft of transmission
4 - driving gear (17 teeth), constant mesh (made as a unit hole with the driving shaft)
5 - driven (secondary) shaft of transmission
6 - driving shaft roller bearing
7 - driving shaft bearing cap (used as a support for clutch collar bushing)
27 - first driven gear (43 teeth)
28 - reverse shifting shaft
29 - first and second gear shifter fork
30 - reverse gear shifter fork
31 - transmission case breather
32 - transmission driven shaft flange
33 - reverse gear section large gear (22 teeth)
34 - reverse gear section small gear (18 teeth)
35 - reverse gear unit shaft
36 - reverse gear unit shaft stop
37 - first driving gear (16 teeth)

8 - driving (primary) transmission shaft
9 - splines for clutch driven plate hub
10 - neck for installation of front (ball) bearing of driving shaft
11 - synchronizer hub
12 - synchronizer blocking ring
13 - gear wheel for fourth gear (made as a unit hole with driving shaft)
14 - sliding tooth collar of synchronizer
15 - steel spacer bushing of third gear driven shaft
16 - upper cover of transmission case
17 - first and second gear shifting shaft
18 - fixer ball and spring
19 - second gear driven gear bronze bushing
20 - driven gear (32 teeth) of second gear
21 - gear of driven shaft of second gear, used to connect with driven shaft of first gear
22 - third and fourth gear shifting shaft head
23 - shift lever
24 - shift lever rubber boot
25 - shift lever steel cap
26 - third and fourth gear shifting shaft

(made as unit hole with intermediate shaft)
38 - third gear driven gear bronze bushing
39 - second gear driving gear (25 teeth) (made as unit hole with intermediate shaft)
40 - third gear driven gear (24 teeth)
41 - third gear wheel used for connection with synchronizer collar
42 - third gear driving gear (34 teeth) (made as unit hole with driven shaft)
43 - transmission oil drain plug
44 - third and fourth gear shifting fork
45 - transmission oil checking hole
46 - dirt trap
47 - synchronizer thrust plate
48 - synchronizer spring wheels
49 - second gear driven gear spacer bushing stop
50 - reverse gear safety preventor spring
51 - shifting shaft lock pin
52 - shifting shaft lock plunger



Operation of Synchronizer when Fourth Gear is Engaged



Transfer Box

Basic Data

Type of transfer box -- gear-type with two speeds forward.
Transfer ratios: direct drive -- 1:1.
reducing drive -- 1.982:1
Box case capacity -- 1.5 l.
Weight of transfer box -- 48.5 kg.

The transfer box is used to transmit torque to the front and rear axles of the truck, and also to increase torque on the driving wheels by introducing a reducing transmission.

The transfer box is connected to the transmission, front and rear axles by the drive shafts.

The mechanisms of the transfer box are mounted in a cast, non-split iron case 1. The gears of the box are on four shafts -- driving shaft 18, rear axle drive shaft 27, intermediate shaft 14 and front axle drive shaft 4.

Splines 19 carry sliding gear 20 which connects the rear axle and the reducing transmission. Flange 17, fastened to the intermediate drive shaft from the transmission, is mounted on the front end of shaft 18 on splines and fastened with a nut. Driving shaft 18 rotates in two bearings -- a ball bearing in the front wall of the case and cylindrical roller bearing 12, in the seat of the shaft driving rear axle 27. This shaft is made as a unit hole with the driven gear, which has outer geared rim 22 and inner teeth 31. Driven gear 30 is a unit hole with its shaft, installed with its lower end in a seat in case 24, its upper end in a seat screwed into a rib of the case. On the rear end of shaft 27 on splines is flange 28, fastened to the central brake drum and the rear drive shaft.

The gear of reducing transmission 12 is seated on splines on the front portion of intermediate shaft 14 and held from axial displacement by a stop ring. Moving gear 34, which engages the front axle and is in constant mesh with the front portion of the outer rim of gear 22 of the rear axle shaft, is splined onto the middle of the shaft. This constant mesh greatly facilitates control of the transfer box, since when the front axle is engaged, it makes it unnecessary to mesh gear 34 with two other gears at once (rim 22 and gear 2).

Breather 26 is installed to prevent the pressure in the transfer box from increasing during operation.

In the rear of the case on the left side (left of the cover of the rear bearing of the front drive shaft) is the oil filler aperture, with threaded plug 37 which is also the oil level test hole. There is an aperture in the lower portion of the case, covered with plug 36, for drainage of oil.

The transfer box is controlled by forks 50 and 51, fastened to shafts 39 and 43. The rear ends of the shafts are closed with tips 38. The front ends of the shafts are sealed with flange 48, compressed by nuts 49, screwed into the case. Arms 56 and 57 are fastened to the shafts on keyed pins; each of these arms carries one adjusting fork 59 on its front threaded end, fixed in place with a counter nut. The forks are connected to the two control levers by keyed pins.

Left lever 60 is used to connect the front axle and has two positions: forward -- axle engaged, rearward -- axle disengaged.

Right lever 61 is used to switch the transmission in the transfer box and has three positions: forward -- direct drive engaged, middle -- neutral, and rearward -- reducing drive engaged. The speeds in the transfer box are shifted by moving gear 20 by means of fork 51.

When the lever is moved forward, gear 20 moves back and meshes with the inner teeth 31. The torque is transmitted from the transmission through the intermediate drive shaft, to shafts 18 and 27 of the transfer box, after which it is transmitted through the rear drive shaft to the rear axle (direct drive).

When the reducing transmission is engaged, gear 20 moves forward and meshes with gear 12.

In this case, the torque is approximately doubled. In order to avoid overloading the transmission, before engaging the reducing transmission it is necessary to engage the front axle by moving the front axle shift lever forward. Then fork 50 moves gear 34 back and it meshes with gear 2.

When the front axle is engaged with direct drive engaged, the torque is transmitted from rim 22 (inner teeth 31 meshed with gear 20) to gear 34 of the intermediate shaft, then to gear 2.

A lock consisting of two hollow pins 42 is seated in a hole drilled in the case between shafts 39 and 43. The force of a spring pushes the spherical ends of these pins into holes in the shafts and fixes them in each position. Shifting shaft 43 has three depressions. The front depression 44 is used to fix the shaft in direct drive position, rear depression 46 -- in reducing drive position. Depression 45 corresponds to the neutral position. On shaft 39 which switches the front axle there are two depressions: depression 41 fixes the front axle shaft in the engaged position, while depression 40 fixes it in the disengaged position. Depressions 40 and 46 are approximately half as deep as the others.

Pins 42 are selected that their total length does not allow one of the shafts to be moved when one pin is in a shallow depression, the other in a deep depression.

With the front axle engaged and direct drive engaged, shaft 43 is shifted to neutral due to the land between depressions 44 and 45. The reducing transmission cannot be engaged, which would require movement of shaft 43 forward

until hole 46 matched pin 42, since pins 42 prevent this movement of the shaft.

Before engaging the reducing transmission, shaft 39 must be moved back until deep depression 41 matches pin 42, i.e., the front axle must be engaged.

The lock makes it impossible to disengage the front axle when the reducing gear is engaged. In this case, shaft 39 is fixed with a pin in deep depression 41, while the other pin 42 is in shallow depression 46 of shaft 43. Since in this position the pin cannot fully leave depression 41, it prevents shaft 39 from being moved forward. In order to disengage the front axle, shaft 43 must be moved back until deep depression 44 or 45 matches pin 42, i.e., shaft 43 must be placed in the neutral position or direct drive must be engaged in the transfer box.

Thus, the lock makes it impossible to engage the reducing drive with the front axle disengaged or to disengage the front axle with reducing drive engaged.

Care of the transfer box consists of maintaining it clean (particularly the breather) and maintaining the required oil level in the case. The level is checked during TO-1 and TO-2. The oil must be at the level of the filler hole. Each second TO-2 (each 11,000-17,000 km) the oil is changed.

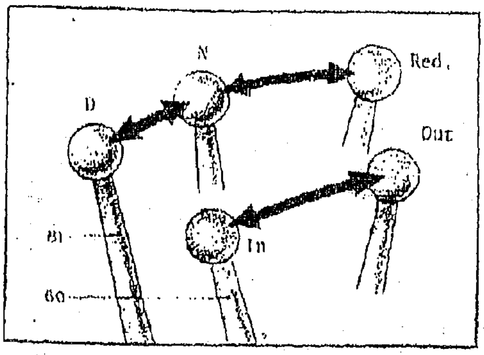
The transfer box is lubricated in summer with type TAp-15 oil, in winter with type TAp-10 oil, GOST 8412-57.

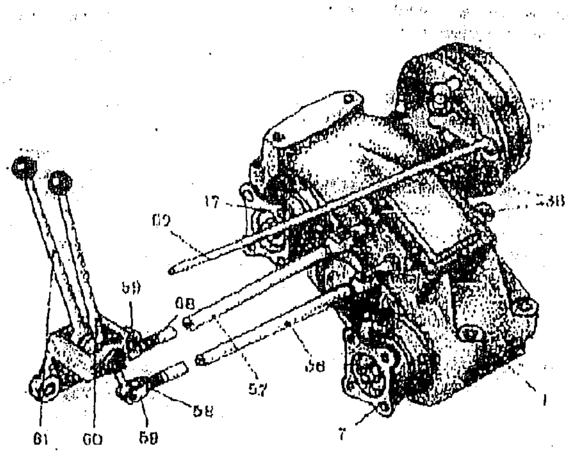
Incorrect engagement of the transfer box and front axle may result from poor adjustment of the length of arms 56 and 57 of the drive mechanism.

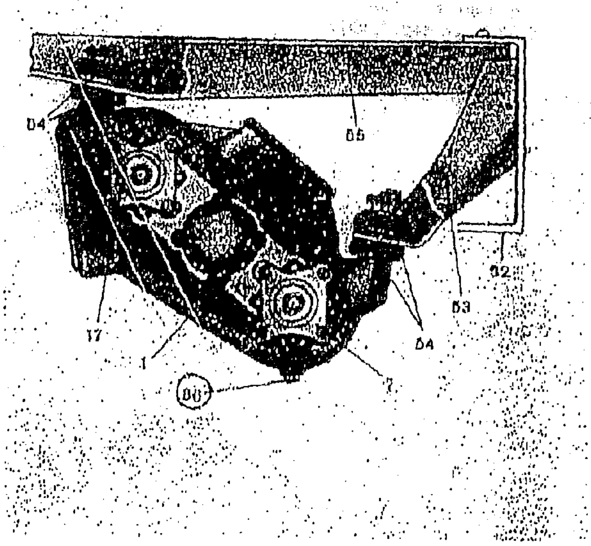
To adjust the position of the lever, it is necessary to remove the key from the pin in the arm, remove it from fork 59, move the shaft to the point that the required gear is fully engaged (fixing pin should be in the depression required), then set the lever in the position corresponding to the gear engaged and rotate the fork to establish the necessary arm length. Then, mate the apertures in the lever and fork, insert the pin, key it and tighten counter nut 58 on the arm.

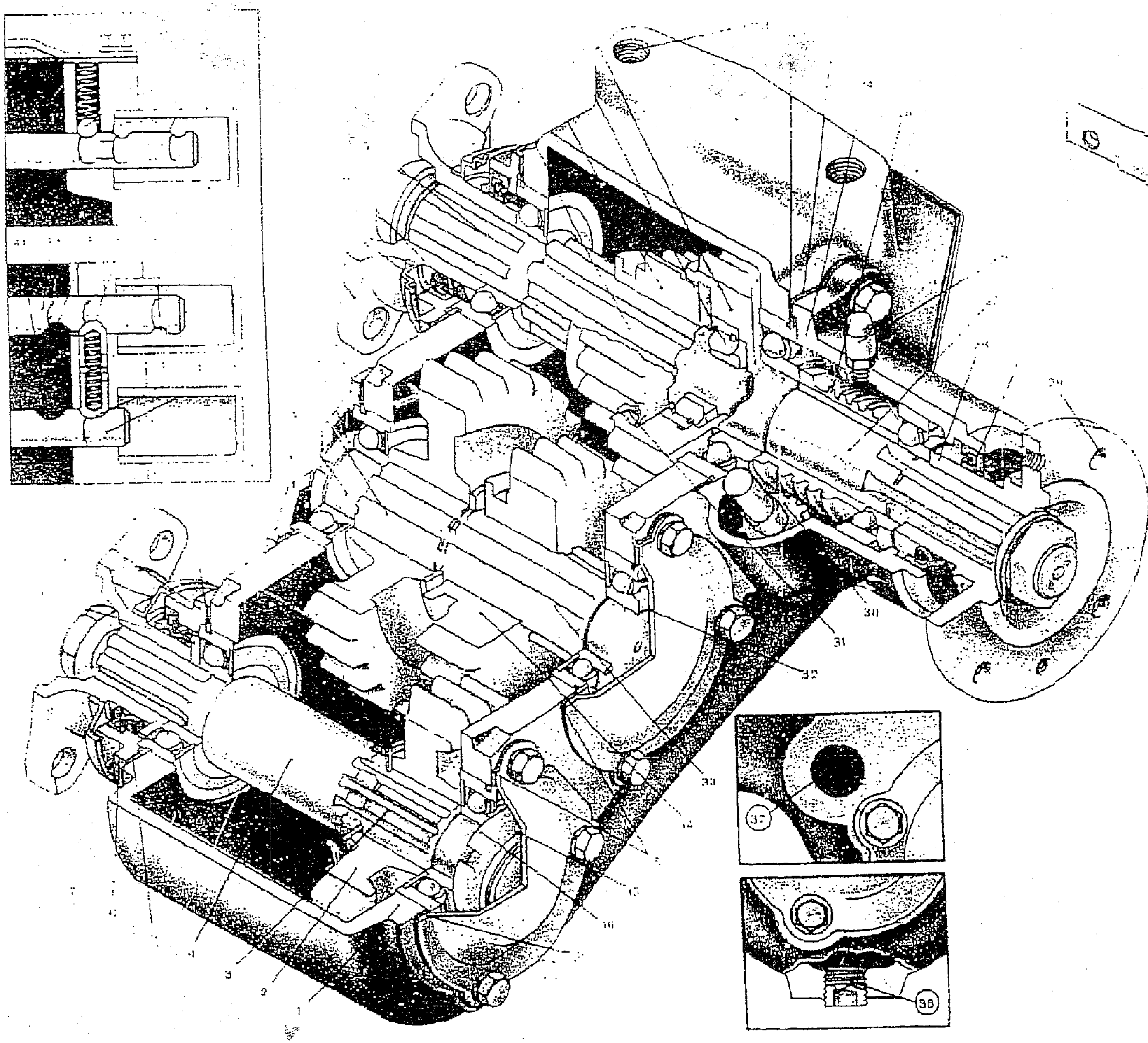
Care of the transfer box drive system, in addition to adjusting arm lengths as necessary, consists in lubrication of the shaft of the transfer box control levers during TO-1 and TO-2.

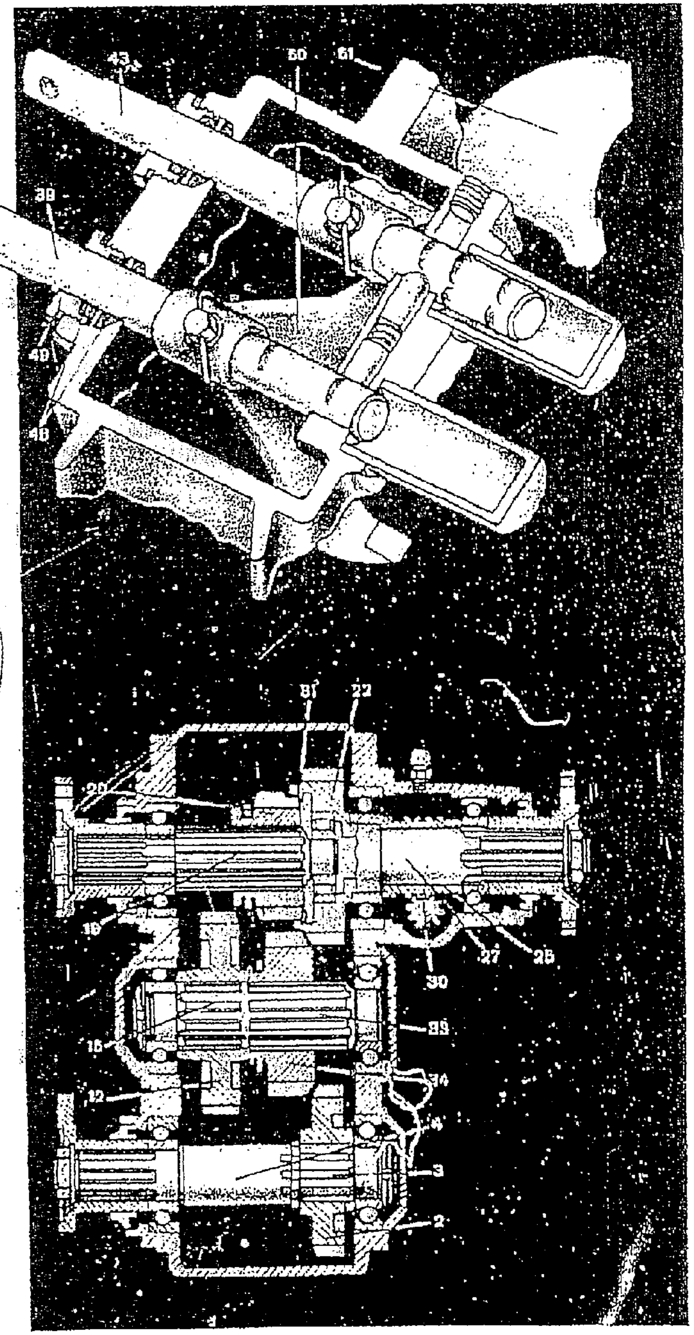
1 - transfer box case
2 - driven gear (27 teeth) of front axle drive shaft
3 - splines holding front axle drive gear
4 - shaft driving front axle
5 - sealing gasket
6 - gland
7 - flange of universal joint to front axle
8 - oil wiper ring
9 - dirt reflector of gland
10 - front cover of drive shaft of front axle
11 - ball bearing stop ring
12 - driven gear (31 teeth) of intermediate shaft reducing transmission
13 - intermediate shaft front cover
14 - intermediate shaft
15 - splines holding lower gear driven gear
16 - ball bearing mounting nut
17 - flange of drive shaft from transmission to transfer box
18 - transfer box drive shaft
19 - splines carrying moving driving gear
20 - moving driving gear (17 teeth)
21 - cylindrical roller bearing
22 - driven gear (27 teeth) for rear axle drive shaft
23 - aperture for pin mounting transfer box to frame
24 - speedometer drive case (cover of front ball bearing of rear axle drive shaft)
25 - driving gear (7 teeth) of speedometer drive
26 - breather
27 - rear axle drive shaft
28 - hand brake drum flange
29 - aperture for bolt mounting drive shaft flange
30 - driven gear (24 teeth) of speedometer drive
31 - inner teeth (17 teeth) of driven gear for engagement of higher (direct) drive
32 - rear cover of intermediate shaft
33 - splines carrying moving gear of intermediate shaft
34 - moving gear (25 teeth) of intermediate shaft for engagement of front axle
35 - rear cover of front axle drive shaft
36 - oil drain plug
37 - oil filler plug
38 - shaft tip
39 - front axle shifting shaft
40 - depression for lock pin (front axle disengage)
41 - depression for lock pin (front axle engaged)
42 - shaft lock pin
43 - high and low gear shifting shaft
44 - depression for lock pin (direct drive engaged)
45 - depression for lock pin (neutral position)
46 - depression for lock pin (reducing drive engaged)
47 - fixer ball
48 - gland and shaft
49 - gland nut
50-51 - forks
52 - longitudinal frame member
53 - frame bracket
54 - rubber supports
55 - frame cross member
56 - arm of lever engaging front axle
57 - arm of transmission shifting lever
58 - adjusting fork counter nut
59 - adjusting fork
60 - lever engaging front axle
61 - transmission shift lever
62 - central brake arm











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Rear Axle and Suspension

Basic Data

Beam (case) -- non-split
Main drive -- hypoid type
Main drive transfer ratio -- 6.83:1
Differential -- cam type
Half axles -- fully unloaded
Weight of axle -- 253 kg
Rear axle capacity -- 7.6 l (6.4 l on vehicles with tire pressure regulation system)
Springs, longitudinal semi-elliptical leaf type
Spring length -- 1,500 mm
Spring stiffness -- 108 kg/cm
Weight of springs 48.5 kg
Shock absorbers -- hydraulic telescopic, double acting
Weight of shock absorber -- 4.8 kg

The beam (case) of the rear axle consists of two stamped halves, welded along the horizontal axis of the axle. A stamped cover is welded onto the rear central portion of the case, and spring mounts 69 are welded onto the top. Flanges 70 are butt welded to the ends of the case, and wheel journals 19, made of alloy steel, are fastened to these flanges with 12 lugs. These same lugs fasten brake disks 7 to the journals. The journals of the front and rear wheels are standardized. On these journals, hubs 11 of the rear wheels are carried on two roller bearings. The hub bearings of the rear wheel are tightened with nut 13 with counter nut 15 and stop washer 17.

The main drive and differential are mounted in separate case 52, carried in a space in the beam (case) of the axle and fastened in with bolts; the reducing drive can be removed from the vehicle assembled without removing the axle.

Half shaft 12 is made of alloy steel. The end of the half shaft is a flange, which is held by 10 lugs and nuts with lock washers rigidly to hub 11 of the rear wheel. The flange of the half shaft is centered relative to the hub by a rib. The internal splined end of the right half axle is connected to the outer sprocket of the differential; the splines of the left half axle are connected to inner sprocket 44.

Trucks with the tire pressure regulating system carry a cover at the end of the flange, to which the tube carrying air to the tire is fastened. At the center of the half axle is a longitudinal channel with a radial aperture, through which the air is transmitted from the hose to the cover. Near the radial aperture, the half axle is large in diameter. At this point, the surface of the half axle is ground and the air sealing unit is attached to it.

When the tire pressure regulating system is not fitted, the half axle of the truck has no channel for air feed for flange cover mounting apertures.

To hold the lubricant in the rear axle casing, cast front cover 57 is equipped with a gland, and oil wiper ring 60 is installed on the splines of the driving gear; the outer surface of this ring has an oil-wiping spiral channel. Glands are also installed in the wheel hubs.

In trucks with the tire pressure regulating system, the casing contains additional glands preventing oil from the case from reaching the air feed seal unit. The hub bearings on these trucks are lubricated with type 1-13 lubricant (GOST 1631-61), placed in the hubs.

To prevent the pressure from increasing inside the rear axle casing as the lubricant is heated during operation, there is a breather connecting the internal cavity in the casing with the atmosphere.

The rear axle carries only special hypoid oil type TS-14.5 with chloref-40 additive (TU TNZ 128-63). Replacement of this oil with another type or mixing with another type is forbidden, since this will always cause early failure of the main drive. The oil is poured in through the hole in the throat of the casing on the right side. This hole also serves to determine the oil level.

The suspension of the rear axle is based on longitudinal semi-elliptical leaf springs, operating with hydraulic shock absorbers.

In order to improve suspension quality, the springs are quite long in comparison with those of other types of trucks (1,500 mm).

The springs consist of nine leaves, retained by center bolt 32 and four clamps 71, preventing lateral movement of the springs. These collar clamps are riveted to the lower leaf and tightened with bolts with spacer tubes preventing squeezing of the spring leaves.

The ends of the two main leaves are riveted to cups carrying rubber support 73, 74, 79 and 80, clamped together with the ends of the springs in bracket 72 and 78 by covers 75 and 81. Each bracket is fastened to a longitudinal frame member by six rivets.

The seats of the front brackets carry additional supports (rubber cushions) which receive shocks from the axles and transmit the frame. The rear ends of the springs move in the longitudinal direction as the springs bend.

Each spring is fastened to the axle by two U-bolts 33, which surround the spring and cover 31 and pass through the apertures in fitting 68. The U-bolts are tightened with nuts.

The bending of the spring is limited by rubber bumpers 35, installed on the lower plates of the longitudinal frame members and resting against the rear axle beam when the springs are greatly bent.

Adjusting hub bearings. Particular attention must be given to periodic checking of the adjustment of the tapered roller bearings of the wheels. Adjustment of these bearings requires that the rear axle be jacked up until the tires are off the ground. Remove half axle 12, loosen counter nut 15, remove lock washer 17, loosen nut 13 by 1/3-1/2 turn and check whether the wheel spins freely. If necessary, eliminate the reason of any difficult rotation (seizing of brake shoes, gland, etc.).

After this, nut 13 is tightened with one hand using a wrench with a handle 350-400 mm long (the wheel should stop immediately after being pushed with the hand).

As the nut is tightened, the wheel must be rotated to assure proper placement of the bearing rollers.

Then nut 13 is loosened by 1/8 turn; stop washer 17 is installed and a check is made to be sure that stop pin 14 has entered one of the notches in the washer. If necessary, the nut can be rotated in one direction or the other until the pin enters the nearest notch on the stop washer. Then counter nut 15 is tightened and the degree of tension on the bearings is checked after tightening of the counter nut. If the tension is correct, the wheel should rotate freely without any noticeable axial movement or wobbling.

The following must be done during TO-2:

jack up the axle and, turning the wheels by hand, check the tightness of the hub bearing; when necessary, adjust tightness of the bearing;

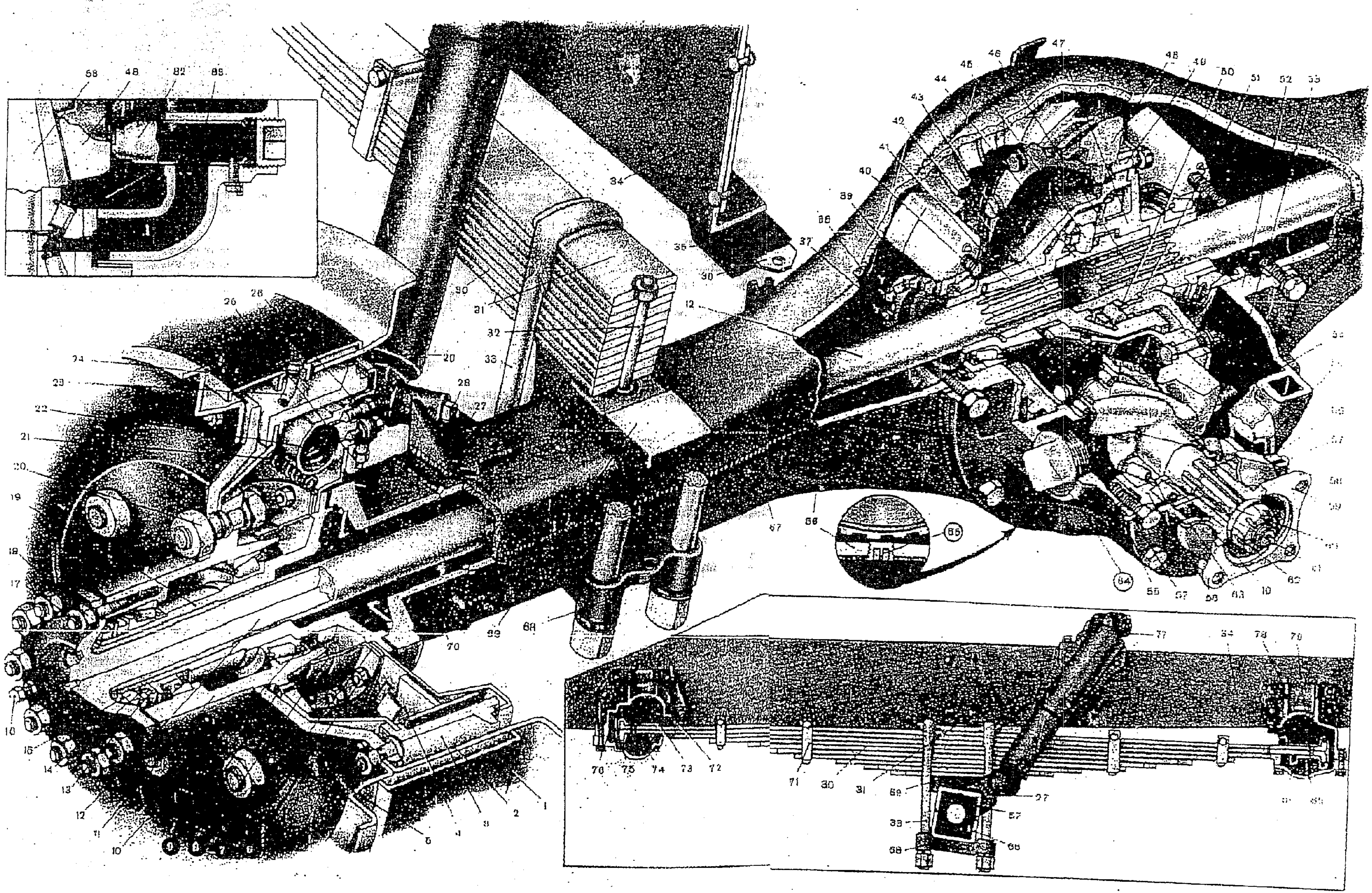
tighten the bolts fastening the reducing gear to the case, as well as the drive gear clutch mounting bolts; check to be sure the breather is not plugged;

test the condition of the spring bracket rivets, as well as the condition of the springs themselves. Be sure that there is no longitudinal displacement of the leaves (indicating shear of the center bolt) and that no cracks have appeared in the leaves. Breakage of individual leaves of the spring is usually accompanied by a change in the bend of the spring; this is easy to observe by looking along the spring and comparing the bending of the two springs. The broken leaf must be replaced by dissembling the spring. If the bracket rivets have been weakened, new, larger rivets or bolts must be used to replace them. In case of rust on the springs, they must be removed, dissembled, washed in kerosene and carefully lubricated with graphite lubricant (GOST 3333-55) or a mixture consisting of 30% universal medium lubricant type US (solidole), 30% type P graphite and 40% transformer oil.

Each second TO-2, remove the hub with brake drums. Carefully wash in gasoline, inspect the hub bearings and their outer rims. If the working surface of the wheel or rollers have spotty wear or coloration, or if the inner circle or separator is damaged, the bearing should be replaced. Check the condition of the hub glands. Before installing the hub on a truck with the tire pressure regulation system, lubricate the bearings and place type 1-13 lubricant (GOST 1631-61) in the hub. Adjust bearing tension.

Also, the tightness of the driving gear flange nut should be checked and the oil in the differential case should be replaced (the oil is drained through the plug in the bottom of the differential case).

1 - tire spacing rim
2 - wheel rim
3 - brake drum
4 - brake shoe with friction liner
5 - disk of wheel
6 - nut mounting brake supporting disk, oil reflector and hub journal to flange of rear axle case
7 - brake shoe supporting disk
8 - oil reflector of hub
9 - brake drum mounting screw
10 - gland
11 - hub of driving (rear) wheel
12 - half axle
13 - hub bearing adjustment nut
14 - stopping pin
15 - hub bearing mounting counter nut
16 - bolt for removal of half axle
17 - stop washer
18 - nut and pin mounting half axle flange to hub
19 - right wheel hub journal
20 - nut and bolt with right hand thread for mounting of right driving wheel
21 - brake shoe return spring
22 - wheel brake cylinder
23 - tire valve tube
24 - tire seal
25 - brake line
26 - brake bleed valve
27 - bracket mounting shock absorber to rear axle
28 - shock absorber mounting pin and nut
29 - telescopic shock absorber
30 - rear spring
31 - upper spring mounting plate
32 - spring center bolt
33 - spring U-bolt
34 - longitudinal frame member
35 - rubber cushion limiting spring bend
36 - metal plate mounting cushion to frame member
37 - nut for adjusting tension of differential roller bearing
38 - stop plate
39 - differential bearing cover
40 - differential bearing cover tension bolt
41 - outer sprocket of differential
42 - differential cup
43 - right half axle splines
44 - inner sprocket of differential with two rows of cams
45 - differential thrust bearing
46 - splines of left half axle
47 - differential separator
48 - main drive driven gear (41 teeth)
49 - bolt connecting separator and cup of differential to driven gear (rim) of main drive
50 - inner sealing ring of differential thrust bearings
51 - outer sealing ring of differential thrust bearings
52 - main drive casing
53 - adjusting screw of main drive driving gear stop
54 - main drive driving gear stop
55 - spacers for adjustment of meshing of bevel gears (can be adjusted only at repair enterprise with precise test devices available)
56 - body of main drive driving gear bearing
57 - front cover of main drive casing
58 - driving gear (6 teeth) of main drive (made one piece with shaft)
59 - flange mounting drive shaft to driving gear of main drive
60 - oil wiper ring
61 - bevel gear spacer ring
62 - shims for adjustment of tapered bearing tension
63 - oil reflector of gland
64 - oil filler plug
65 - oil drain plug
66 - lower half of rear axle casing
67 - upper half of rear axle casing
68 - U-bolt lower fitting
69 - spring bumper
70 - rear axle casing flange
71 - spring collar
72 - front spring bracket
73 - upper front rubber spring bumper
74 - lower front rubber spring bumper
75 - spring front bracket cover
76 - spring stop
77 - upper head of shock absorber
78 - rear spring bracket
79 - upper rear rubber spring bumper
80 - lower rear rubber spring bumper
81 - rear spring bracket cover
82 - oil wiper bushing
83 - upper channel for oil feed to bearings



Main Drive and Differential

Basic Data

Main drive -- hypoid type
Transfer ratio -- 6.83:1
Hypoid shift -- 32 mm
Differential -- cam type, high friction, with radial placement of cams
Weight of reducing unit assembled -- 74 kg

Main drive. The gears of the main drive and differential are installed in a separate reducer casing, mounted to the rear axle beam with ten bolts. Driving gear 23 of the main drive is made of alloy steel as a unit hole with its shaft. It is supported by two tapered roller bearings mounted in collar 26, and one cylindrical roller bearing mounted directly in a seat in case 24 and fastened to the shaft by a stop ring. The tapered bearings are fastened by flange 27 and crown nut 28 with a washer and key. The preliminary tension of the tapered roller bearings of the driving gear is adjusted with shims 25 placed between a spacer ring and the end of the inner rear tapered roller bearing circle. The thickness of the shims is 0.15, 0.20 and 0.25 mm.

In the rear axle, great attention is given to lubrication of the tapered bearings of the drive gear. Lubricant is fed to these bearings under pressure, for which purpose there is an oil wiper bushing in the casing which, as it contacts the driven gear, collects the oil from it. The bushing is pressed against the gear by a threaded plug through a spring and is stopped from rotation by a bolt. The oil from the bushing is fed through the upper channel to the bearings and returned through the lower channel.

Driven gear 1 of alloy steel is fastened to the flanges of separator 10 and cup 9 of the differential by bolts with crown nuts. The separator and cup rotate in tapered roller bearings set in seats in the casing and covered with caps. The seats in the case and cover, as well as the threads are made assembled, and therefore must be returned to their original places after disassembly. The covers are centered with special pins.

The tension on the driven gear bearings is adjusted with nuts. These same nuts adjust the side clearance, as well as the hypoid gear contact spot size and location.

In order to prevent great deformation of the driven gear as maximum force is transmitted, an adjustable type stop is included in the casing of the reducer (to assure constant clearance between the stop and the driven gear). It consists of a screw, a bronze bushing pressed onto the screw and a nut. During operation of the truck, the position of the adjusting screw should not be changed. If for some reason the tightness of the nut is reduced, the adjusting screw should be turned to full tightness, then backed off by 1/6 turn and the counter nut tightened. This will correspond to a clearance of 0.25 mm between the ends of the driven gear and the bushing of the stop.

Adjustment. The bearings of the rear axle, the lateral clearance and contact between the gears are adjusted at the plant; during operation, they should not be adjusted. The necessity of adjustment arises only when parts are replaced or if the bearings are greatly worn.

The bearings of the driving gear must be adjusted if the axial clearance exceeds 0.03 mm. The axial clearance is checked using an indicator to show the movement of the driving gear from one extreme position to the other.

To adjust the clearance, remove collar 26 with the driving gear and bearings assembled, then loosen the mounting nut of drive shaft flange 27, remove the flange, gland cover and inner circle with rollers of the outer bearing. Remove one or more shims 25, so that after assembly of collar 26 without the gland cover, the driving gear rotation resistance is between 6 and 14 kgcm. After adjustment, tighten nut 28 fully, so that one of its notches matches the hole for the key. It must not be backed off even a little to make the keyhole match a notch in the nut. If the tightness of the nut is insufficient, the inner circle of the bearing may rotate, causing wear of the shims and, as a result, greatly increasing the axial displacement of the driving gear. When nut 28 is tightened during assembly of collar 26, rotate flange 27 so that the rollers of the bearings will find their proper positions in both circles.

The bearings of the differential are first tightened so that they have no axial displacement, then each adjustment nut is tightened by one more notch. In adjusting the lateral clearance of gear mesh, retain preliminary tightness of the differential bearings. To do this, when the nut on one side is loosened, the nut on the other side must be tightened by the same number of notches. The lateral clearance between main drive teeth should be 0.15-0.3 mm.

After adjusting the bearings and lateral clearance between gear teeth, use paint to check the position of the contact spot of the driving gear teeth, which should be at the center of the tooth on both sides and should not contact the tip or base of the tooth; the spot may be slightly shifted toward the narrow end of the tooth.

Differential. In order to increase the performance of the truck, the front and rear axles include limited slip differentials.

Separator 10 carries two rows of radial apertures (24 apertures) in checkerboard order. They carry thrust blocks 8.

Stop rings 16 and 20 are placed between the rows of apertures on the inner and outer surfaces of the separator, preventing the blocks from rotating around their axes, and also preventing them from falling from the separator during assembly of the differential.

Outer sprocket 2 is placed freely in the aperture in cup 9 of the differential, while inner sprocket 6 is placed in the apertures of the separator and outer sprocket. The outer sprocket is connected to half axle 3, the inner sprocket -- to half axle 4, by means of splines. The outer sprocket has six evenly spaced cams around its circumference, which clamp both rows of thrust blocks. On the inner sprocket are two rows of cams (six cams in each row), placed in checkerboard order. Each row of cams in the inner sprocket contacts the corresponding row of thrust blocks in the separator. The cams, separator and blocks are made of alloy steel. Their friction surfaces have high hardness. To improve the running-in properties of these parts, their surfaces are treated with salts of iron and manganese.

As the separator rotates, the thrust blocks, their ends resting against the cams of the sprockets, cause them to rotate. The placement of the cams and blocks in checkerboard order makes it impossible for the sprockets to be located so that the blocks could begin to move back and forth in their seats, allowing the separator to remain still.

If the outer sprocket encounters greater resistance than the inner sprocket, it will rotate more slowly than the separator. In this case, the outer sprocket will push the blocks inward toward the inner sprocket with its cams; the blocks, pressing against the cams of the inner sprocket, will cause it to rotate more rapidly. The rotation of the outer sprocket is likewise accelerated in case the rotation of the inner sprocket is slowed.

This interaction of the differential parts occurs when the vehicle turns or if one of the wheels spins.

If one of the sprockets rotates relative to the other, considerable forces of friction arise between the blocks and cams.

These forces on the lagging wheel are directed in the direction of rotation; therefore, the torque on it, on its half axle and on the lagging wheel is increased significantly. As a result of this, when one wheel of a vehicle with a cam differential begins to spin, the other wheel (lagging wheel), if it has good adhesion with the ground, transmits considerably more force than when a vehicle with a gear differential encounters wheel spin. Tests have shown that when one wheel spins, the pulling power of a vehicle with a cam differential is approximately double that of a vehicle with a gear differential.

The blocking factor -- the ratio of pulling force on the nonspinning wheel to the total force on the spinning and nonspinning wheels -- is 0.8 for a cam differential, 0.55 for a gear differential.

The cam differential allows the wheels to roll without slipping on turns, increases the stability of movement of the vehicle on slippery roads, and operates automatically, requiring no adjustment or care during operation.

It is generally not necessary to dissemble the cam differential during operation. However, if the necessity does arise, the lateral clearance in the contact of thrust blocks and cams of the sprockets must be checked (it should be between 0.3 and 1.6 mm when measured at a radius of 62 mm), as well as the contact between thrust blocks and cams (area of contact of blocks should be at least 75%; before checking contact, the contacting surfaces of the cams should be covered with a thin layer of paint).

1 - gear rim (41 teeth) driven gear of main drive
2 - outer sprocket of differential (with 6 inner cams in 1 row)
3 - right half axle of truck
4 - splines on half axle for connection with outer sprocket
5 - differential bearing
6 - inner sprocket of differential (with 12 external cams in 2 rows of 6 each)
7 - outer cams (6) of first row
8 - thrust blocks (12) of first row
9 - differential cup
10 - differential separator
11 - apertures for oil feed to outer sprocket
12 - apertures for oil passage to cams and blocks of first row
13 - thrust blocks (12) of second row
14 - left half axle
15 - outer cams (6) of second row
16 - outer wheel blocking thrust blocks
17 - splines of half axle for connection to inner sprocket
18 - splines of inner sprocket for connection to left half axle
19 - internal cams of outer sprocket
20 - internal ring stopping thrust blocks
21 - splines of outer sprocket for connection with right half axle
22 - aperture for passage of oil to cams and blocks of second row
23 - driving gear (6 teeth) of main drive
24 - casing of driving axle of vehicle
25 - shims for adjustment of tapered bearing tension
26 - bearing collar
27 - drive shaft flange
28 - crown nut, blocked with key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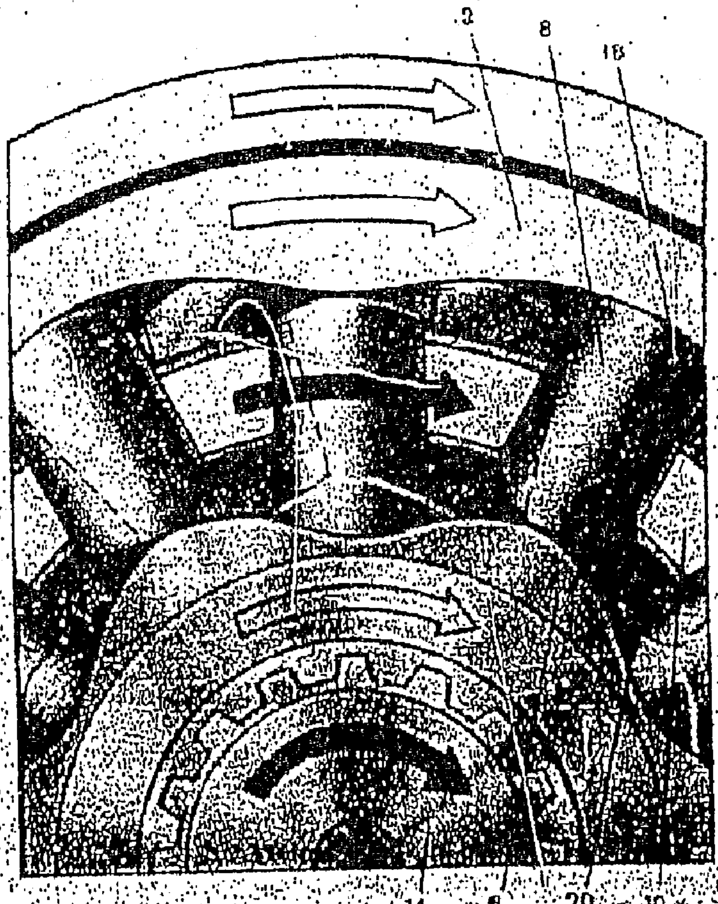
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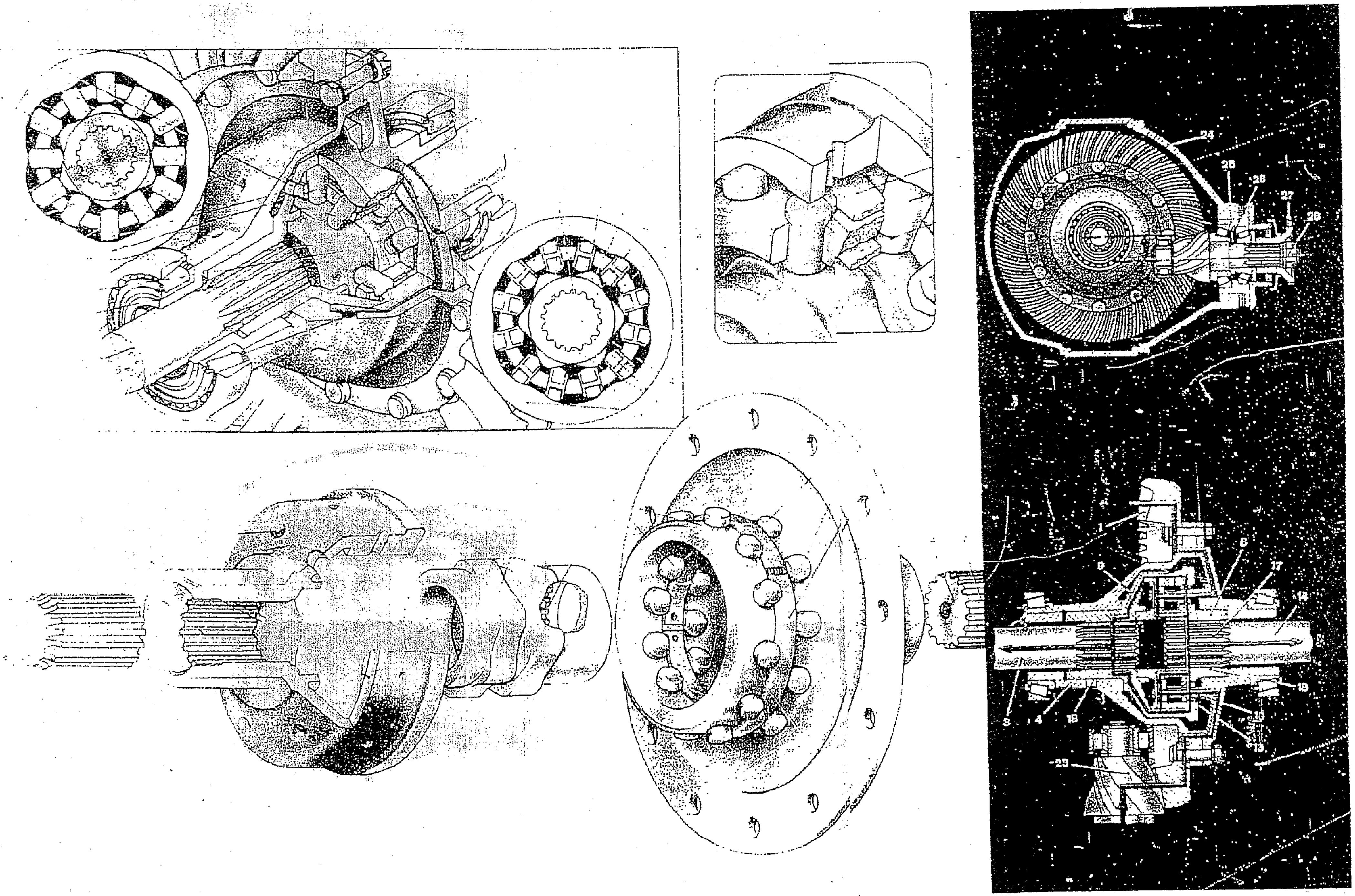

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185-a

Front Driving Axle

Basic Data

Beam -- nonsplit, welded of two stamped halves
Main drive -- hypoid type
Differential -- cam type
Turning cams -- with constant velocity joints
Weight of axle (without wheels) -- 330 kg

Structure. The front driving axle transmits torque from the front drive shaft to the front steered wheels.

The main drive, main drive reducer and differential casing of the front and rear axles are standardized.

The front axle casing is of rectangular cross section, consisting of two stamped steel halves, welded along the horizontal axis of the axle. The central portion of the casing 57, including the reducer, is shifted to the left relative to the longitudinal axis of the vehicle. A steel stamped cover is welded to the front of the casing. Furthermore, spring supports and the cushions of the front spring bumpers are welded to the top of the front axle, flanges are welded to the ends. Spherical support 31 of the rotating cams is fastened to each flange with lugs; within this support is a constant velocity joint.

The outer end of body 16 of the rotating cam, made of foundry cast iron, is fastened by lugs to the flange of rotating journal 20. Hub 32 of the front wheel is mounted on two conical roller bearings 19 on the journal.

The body of the rotating cam with journal 20 rotates on two tapered roller bearings 10, the inner circles of which are set on kingpins 13, welded to the spherical support, while the outer circles are placed in apertures in the body of the rotating cam.

Lower cover 9 of the kingpin bearings is fastened to the body of the rotating cam with four bolts. The cover of the upper bearing of the left journal is mounted with four bolts, carrying tapered sectional bushings to assure a tight, reliable joint. This cover is made of alloy steel as a unit hole with lever 2, connected to the longitudinal steering arm.

Between the covers and body of the rotating cam are steel inserts 11, designed to adjust the tension in the kingpin bearings.

In order to retain lubrication in the joint and bearings, and also to protect them from dirt, the outer surface of the spherical support carries gland 12, the body of which is fastened by 12 bolts to the body of the rotating cam. The internal portion of the gland consists of a rubber collar and a pressure spring, the outer portion consists of a felt ring.

The upper covers of the bearings carry press oilers 39 (during lubrication, plug 17 must be removed) in order to allow the bearings of the kingpins and joints to be filled with lubricant.

The constant velocity joint consists of two cams: the internal driving cam 44 and external driven cam 24. The torque from the driving cam is transmitted to the driven cam through four driving balls 40 in the channels between the cams. Central ball 21 is mounted on pin 23 and serves to center the cams.

The driving balls and cams are selected so as to provide preliminary interference in the joint. The torque necessary to rotate the driving cam by 10-15° in either direction from the vertical with the driven cam pressed in should be 450-750 kgcm. In order to provide the required interference, the balls are sorted into nine groups by sizes. Each joint carries balls of only one group. Two neighboring groups of balls can be used in pairs.

Longitudinal displacement of the joint is prevented by stop washer 38.

The splined end of the driving cam is connected to one of the sprockets of the differential. The rod of the cam has a thicker, splined neck which contacts the gland pressed into its seat on the inner end of the spherical support.

The splines of the driven cam carry driving flange 27, fastened to the hub with 10 lugs. Cap 25 is fastened to the driving flange.

To dissemble the constant velocity joint, it is necessary to: use paint or chalk to mark the mutual placement of the cams of the joints; set the joint vertically with driven cam 24 upward, so that pin 23 can drop down into the aperture of the central ball 21 under its own weight (if the pin does not drop, tap the end of the driving cam against a wooden support or spread the cams and push the pin down with a screwdriver), rotate the central ball together with the pin and remove the pin. Then rotate the central ball toward one of driving balls 40; then bend the driving cam and slip out one of the driving balls from the joint. After this, the remaining balls can be removed easily. The joint is assembled in the opposite sequence.

Particular attention must be given to the condition and tightness of the kingpin bearings. The bearings must be adjusted with preliminary interference: lack of tension may cause bearing failure. The degree of tension of the bearings should be tested with the axle raised on a jack and the steering arms removed. The tension is checked by rolling the wheel to several positions by hand, rotating the cam on the kingpin. If friction is felt, the tension of kingpin bearings 10 must be adjusted. During adjustment of the kingpin bearings, remove shims 11, 0.10 and 0.15 mm thick, removing identical numbers of shims from above and below, since otherwise coaxiality of the parts of the rotating

cam will be disrupted. The difference between the total thicknesses of upper and lower shims should not be over 0.1 mm.

In order to decrease power losses, and also decrease wear of front axle parts, where the tire pressure regulating system is not installed, a device is used to disconnect the front wheels from power. A collar is installed and fastened on the splined end of the driven cam. The outer splines of the collar mesh with the driving flange of the front wheel hub. To disconnect the wheels, remove protective cap 25 and, removing the bolt from the driven cam, pull back collar 25 until it does not mesh with driving flange 27. The collar is then stopped in place with positioner 22, consisting of a stop and spring.

To reconnect the wheels, remove the protective cap and screw the bolt back into the driven cam fully (the ends of the collar and driving flange must be matched).

The front wheels should be disconnected in this manner when driving over dry, hard roads.

Maintenance. During the TO-1 maintenance cycle, check the tightness of the hub driving flange lug nuts; level of oil in the axle and, if required, add oil (use type TS-14.5 oil with chloref-40, TU TNZ-128-63); lubricate the kingpins through the press oiler with type AM lubricant (GOST 5730-51).

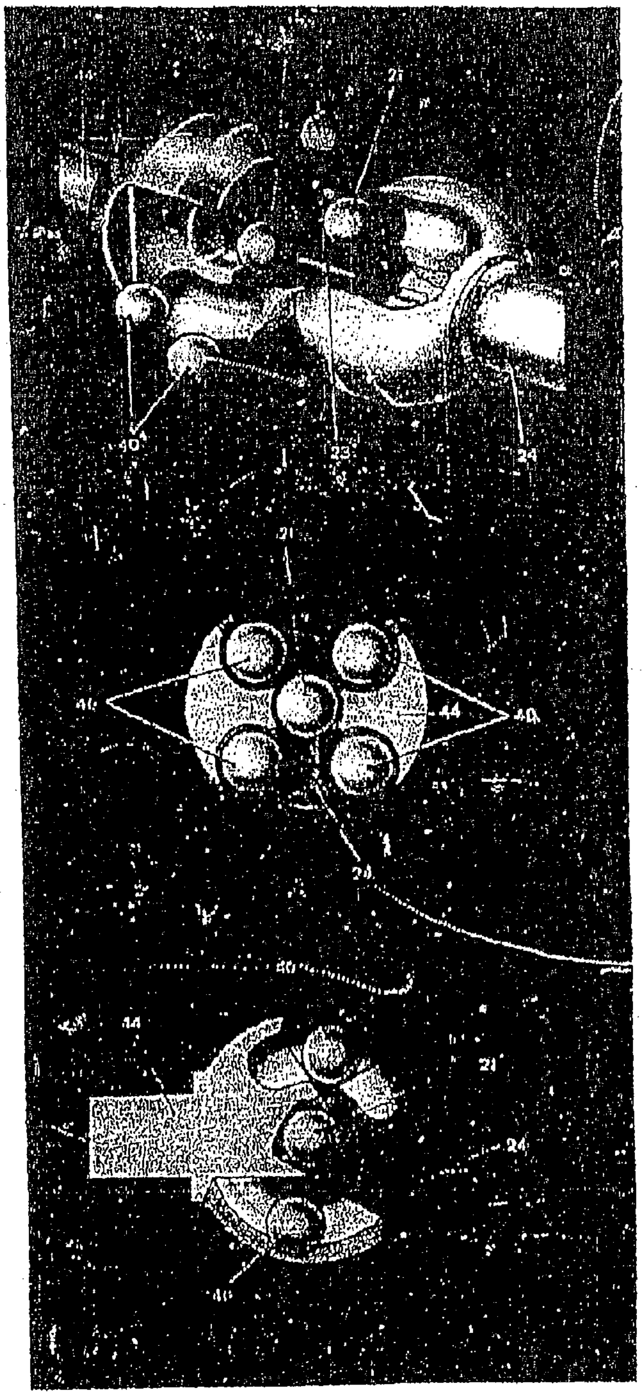
During TO-2, check the tightness of the spherical support mounting nuts;

test adjustment of kingpin bearings;
check breathers for blockage;
tighten the bolts mounting the reducer and the bolts mounting the bearing collar cover of the driving gear;
add 200 g AM lubricant to each rotating cam;
raise the axle on jacks, turn the wheels by hand to check the tightness of the hub bearing, adjust if necessary.

Each second TO-2, remove the hubs from the brake drum. Carefully wash in gasoline and inspect the hub bearings and their outer circles; if spotty wear or discoloration is observed on the working surfaces of the outer circles, or if the side pieces of the inner circle or separator are damaged, the roller bearings must be replaced. Check the condition of the wheel hub glands. Before returning the hub to its place, lubricate the bearings and add the necessary quantity of lubricant type 1-13 (GOST 1631-61) to the hub. Adjust the tension of the bearings.

Check the tightness of the driving gear flange nut. Replace the lubricant in the case. Dissemble, wash the cams and bearings of the kingpins and add 500 g AM lubricant to each cam.

1 - low pressure tire casing
2 - inner tube
3 - rim
4 - spacer ring
5 - inner rim
6 - brake mounting panel
7 - brake drum
8 - brake wheel cylinder
9 - lower cover of kingpin bearing
10 - tapered kingpin roller bearing
11 - shims adjusting kingpin bearing tension
12 - rotating journal gland
13 - rotating journal kingpin
14 - wheel disk
15 - screw mounting brake drum to hub
16 - rotating cam body
17 - plug for checking level of lubricant
18 - hub gland
19 - hub tapered roller bearing
20 - rotating journal
21 - central ball of joint
22 - shifting collar stop
23 - central ball pin
24 - driven cam
25 - protective cap
26 - wheel connection collar
27 - driving flange of hub
28 - cabin entry step
29 - counter nut
30 - lock washer mounting hub bearings
31 - hub bearing nut
32 - wheel hub
33 - brake shoe return spring
34 - brake shoe with friction liner
35 - tire valve tube
36 - bypass valve
37 - brake line nipple
38 - stop washer
39 - oiler
40 - driving ball (4)
41 - spherical support
42 - rotating journal lever
43 - ball finger of steering arm ball joint
44 - driving cam
45 - half axle cover
46 - differential tapered roller bearing
47 - differential bearing adjusting nut
48 - adjusting nut stop
49 - rear axle cover
50 - differential bearing cover
51 - differential thrust block
52 - driven gear
53 - differential cup
54 - outer sprocket of differential
55 - inner sprocket of differential
56 - differential separator
57 - main drive reducer case
58 - stop adjusting screw
59 - driven gear stop
60 - driving gear cylindrical roller bearings
61 - driving gear of main drive
62 - shim for adjustment of tapered bearings
63 - spacer ring
64 - tapered bearing cup
65 - shims for adjustment of bevel gear mesh
66 - drive shaft flange
67 - driving gear shaft gland
68 - tapered roller bearing of driving gear
69 - reducing gear case plug
70 - lower channel for drainage of oil from tapered bearings
71 - upper channel for oil feed to tapered bearings



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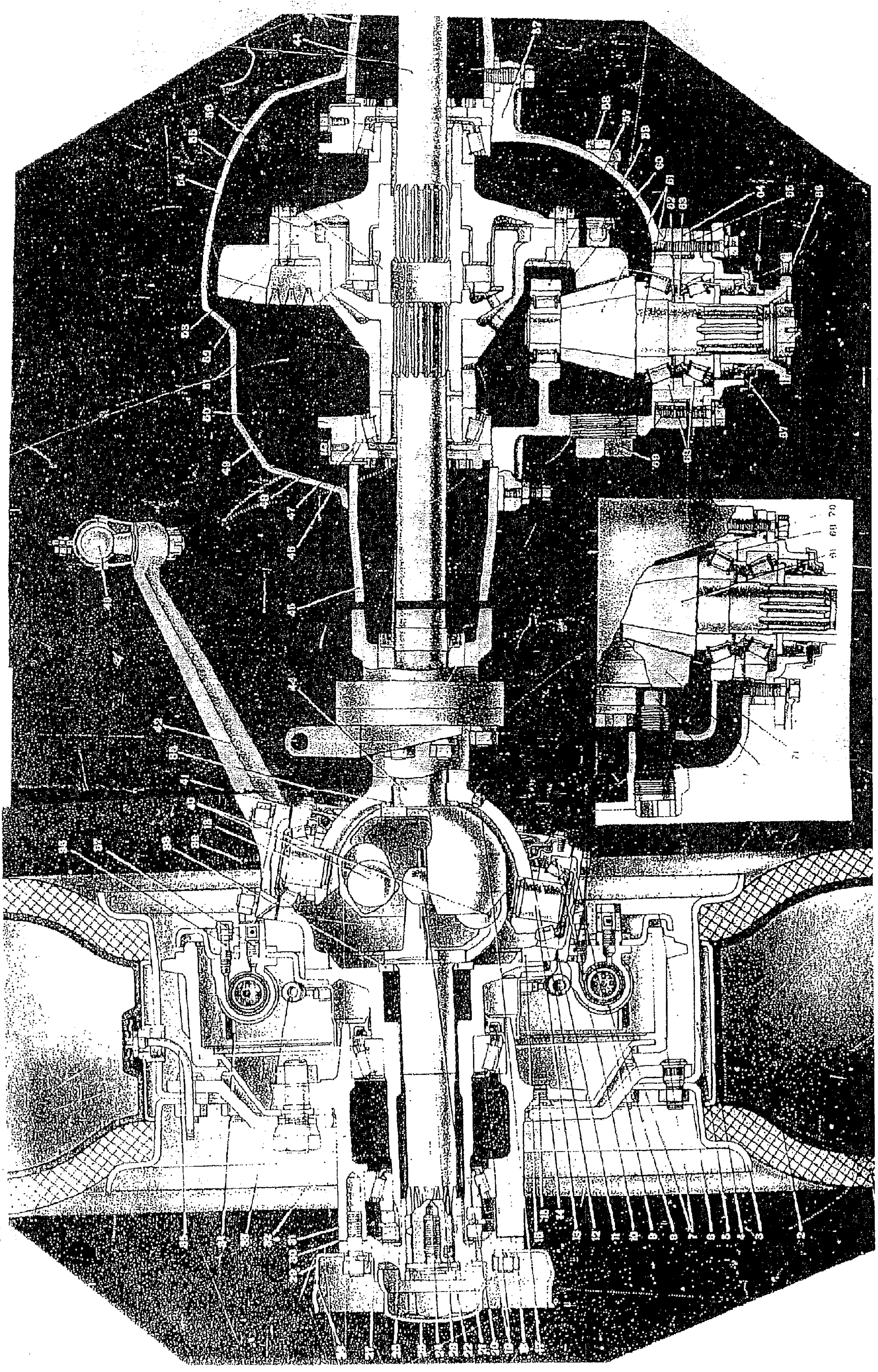


During TO-2, the toe-in of the front wheels is also checked and adjusted if necessary; improper toe-in of the wheels makes steering more difficult and causes high tire wear, excessive gasoline consumption and is also dangerous.

The toe-in of the wheels is adjusted by changing the length of transverse steering arm 24. This requires that left tip 8 of the arm be disconnected from the body of the rotating cam, after which the mounting bolts of the tip are loosened and, by screwing the tip further on or off, the proper arm length is set to provide normal wheel toe-in.

If normal toe-in cannot be achieved, the length of the arm must be further adjusted using right tip 8, which has a finer thread spacing. The distance of the center of the right joint to the nearest end of the welded area (base) of bracket 67 must be 363 1.5 mm. This is necessary for normal operation of the power steering mechanism and assurance of the required maximum turning angle of the front wheels.

1 - left longitudinal frame member
2 - upper rubber spring bumper
3 - upper front spring cup
4 - lower front spring cup
5 - front spring bracket cover
6 - lower rubber spring mount
7 - transverse steering arm ball pin
8 - transverse steering arm tip
9 - transverse steering arm joint oiler
10 - transverse steering arm tip spring
11 - upper and lower joint inserts of transverse steering arm
12 - basic leaf No 1 of spring
13 - basic leaf No 2 of spring
14 - power steering power cylinder
15 - front spring support
16 - tube feeding oil to power cylinder
17 - oiler for lubrication of power cylinder mounting joint
18 - main drive driving shaft
19 - power steering cylinder mounting bracket
20 - front cover of differential casing
21 - differential casing
22 - oil filler plug
23 - hoses feeding oil to power cylinder
24 - transverse steering arm
25 - front spring U-bolt
26 - lower shock absorber mounting bracket
27 - rotating cam body
28 - pin for mounting front axle journal
29 - rotating cam gland
30 - kingpin roller bearing
31 - channel feeding compressed air to centralized tire pressure regulating system
32 - driven cam (driven fork) of constant velocity joint
33 - spherical support of rotating cam
34 - top kingpin
35 - left rotating cam lever
36 - oiler for lubrication of kingpin bearings and rotating cam joint
37 - spring
38 - front spring cover
39 - longitudinal steering arm
40 - spring retaining collar
41 - oiler for lubrication of longitudinal steering member joints
42 - steering mechanism mounting bracket
43 - steering mechanism on ball pin
44 - steering mechanism arm
45 - valve controlling power steering amplifier
46 - power steering return hose
47 - front spring rubber stop
48 - front spring front bracket
49 - power steering unit delivery hose
50 - steering mechanism case
51 - test plug of oil filler aperture of steering mechanism
52 - steering mechanism univeral joint
53 - universal joint oiler
54 - intermediate steering shaft
55 - steering shaft universal fork
56 - tube feeding oil to power steering mechanism
57 - cross member No 1 (traverse) of frame
58 - shock absorber
59 - right longitudinal beam of frame
60 - upper shock absorber mounting bracket
61 - front axle beam
62 - rotating cam gland clamp
63 - rotating cam upper fitting
64 - front spring center bolt
65 - right driving half axle
66 - power cylinder piston shaft
67 - bracket mounting shaft to transverse steering arm
68 - front spring rear bracket
69 - pump oil filler tank
70 - oil pump body of booster
71 - pump drive belt
72 - pump bracket installation plate
73 - pump drive pulley

Suspension of Front Driving Axle and Drive from Steering Mechanism

Basic Data

The front axle is suspended on two longitudinal semi-elliptical springs with hydraulic telescopic double acting shock absorbers. Pushing force is transmitted through the front end of the spring.

The springs are longitudinal, semi-elliptical leaf types, on rubber supports. Spring length -- 1,500 mm. Bending arm of spring: in free state -- 146 mm; under load of 1,200 kg -- 22 ± 5 mm.

The front axle is driving and steered. The torque is transmitted through the main drive and synchronous type universal joints (constant velocity joints).

Wheel setting angles. Angle of inclination of lower end of kingpin forward [caster -- Tr.] -- 3°30'. Side slope of kingpin -- 9°. Camber angle of wheels -- 0°45'. Toe-in of wheels B - A = 2-5 mm.

Tires -- tube-type, low pressure. Size 1,200 × 18.

Steering mechanism drive -- steering mechanism on left with booster.

Booster of steering drive consists of the following units:

power supply -- a double-action rotor-blade hydraulic pump driven by the motor;

power cylinder converting oil pressure to additional force acting on transverse arm of steering trapezoid;

distributor device -- slide-type valve built into longitudinal steering arm.

Front axle suspension. The longitudinal, semi-elliptical leaf springs 37 of the front axle suspension are fastened to front axle beam 61 by two U-bolts 25 each. The springs are fixed relative to the axle with center bolt 64, the head of which fits into an aperture in spring cover 38.

The bending of the springs is limited by rubber bumpers installed on the lower panels of longitudinal frame members 1 and 59 resting (when the spring is highly bent) in brackets welded to the front axle beam. Furthermore, the front springs have additional bumpers, the brackets of which are fastened to the vertical sections of the longitudinal frame members. At great spring deflections, the additional bumpers touch first, thus increasing the stiffness of the springs and requiring more force for the main bumpers to touch the axle beam. The additional bumpers also decrease the rotation of the front axle reducer (during braking), preventing damage to the joint.

The front and rear springs are identical. To assure good suspension quality, the springs are 1,500 mm long.

The springs consist of nine leaves, carried in four collars 40. Each collar is fastened to the lower leaf of the spring by a bolt with a spacer tube preventing distortion of the spring leaves.

The ends of the two main leaves 12 and 13 are riveted to cups 3 and 4 which rest in rubber supports 2 and 6, squeezed, together with the ends of the springs, in brackets 48 and 68 with covers 5.

The front brackets carry additional rubber stops 47, which receive pushing forces from the axles and transmit them to the frame. When the springs bend, their rear ends move in the longitudinal direction.

Maintenance of springs. During TO-1, check and tighten the spring U-bolts if necessary (this should be done with the truck fully loaded); also check the tightness of the bolts in the spring bracket caps. During TO-2, also check the condition of the rivets of the spring brackets, the condition and mounting of the springs. During the inspection check to see whether cracks have appeared in the leaves or whether the leaves are displaced longitudinally, which may occur as a result of shearing of center bolt 64. Breakage of individual leaves of the springs is usually accompanied by a change in the bend of the springs. A broken leaf must be replaced by dissembling the spring. In case of weakening of rivets, they must be replaced by larger rivets or bolts.

At least once per year, and also if sqeaking appears in the springs or rust is noted, the springs must be dissembled, washed in kerosene and each leaf carefully lubricated with graphite.

Steering drive system. The drive between the steering mechanism and the steered wheels is transmitted through lever 44 to longitudinal steering arm 39 and through the lever of the left rotating cam 35 to body 27, which in turn rotates transverse steering arm 24 through pin 7 and spherical support 33 of the right rotating cam.

Splines 28 carrying the journals and wheels rotate together with the bodies of the cams.

Transverse steering arm 24 has tips 8 fastened to the arm at the proper position by bolts.

In the head of the tip of the transverse arm are upper and lower inserts 11, between which spherical pin 7 is held by spring 10. The head is covered at the bottom by a stamped cover and gasket.

The transverse arm joints require no adjustment. By screwing the tip in or out, the length of the transverse arm can be adjusted, thus adjusting the toe-in of the wheels. Press oilers 9 are used to lubricate the joints on the heads of the tips; excess lubricant flows out through the apertures in the lower head covers. The transverse arm joints are sealed with rubber caps clamped between the heads of the tips and the rotating cam body levers.

When a transverse steering arm is removed for any reason and then replaced, care must be taken to see that the clearance between the bent portion of the arm and the main drive reducer is about 30 mm.

Maintenance of steering drive mechanism. Each day, before driving, check the clearance (free play) of the steering wheel. With the engine on and the booster of the power steering operating (wheels set straight ahead) it should be not over 10°, with the power steering off -- 30°. The main reason for increase clearance is excessive clearance in the steering arm joints.

During TO-1, the mounting of lever 35, the spherical pins of the longitudinal steering arm, spherical pin 7 of the transverse steering arm are checked; the fastening of power steering casing 50 and arm 44 are tested; the pin of the joint of the power cylinder 24 and bracket 19 mounting the cylinder are checked, and the clearances in the kingpins of the rotating cams are tested and the joints and kingpins are lubricated through oilers 9, 17, 36 and 41.

volume of fluid in cavity B increases, since a portion of the volume is occupied by shaft 16. Therefore, the fluid flows not only into cavity B, but also into reservoir 17, as a result of which the air located above the fluid in reservoir 17 is compressed, creating air cushion 49.

The fluid passes from cavity A into cavity B through apertures 38 (outer row) in piston 12, overcoming the resistance of bypass valve 37, and into the reservoir through central aperture 9 in nut-seat 42, then through the central and side apertures 51 of compression valve into the lower portion of body 3 and through the lower central aperture into bypass channels 5. Depending on the rate of the oscillations of the suspension of the truck, compression valve 4 changes its position, overcoming the resistance of spring 44. This correspondingly changes the free cross section of lateral aperture 51 in the rod of the channel, through which the fluid flows into the lower portion of body 3, providing smooth movement of the shock absorber.

During the rebound stroke, lower lug 1 drops (or the frame rises when the load on it is decreased), and the volume in cavity A of operating cylinder 15 increases more rapidly than the volume in cavity B decreases; therefore, the fluid enters cavity A not only from cavity B, but also from reservoir 17. The flow of the fluid results not only from the change in the volumes of cavities A and B as the suspension moves, but also from the influence of the air compressed in the upper portion of the reservoir.

The fluid flows from cavity B into cavity A through passages 50 in bypass channel 37, then through apertures 15 (inner row) in piston 12 through circular slit 52 between bushing 40 of the piston and rebound valve 39. If the movement is rapid, valve 39 opens, the cross section of the slit over the valve increases and the fluid, overcoming the resistance of the valve spring, flows into cavity A of operating cylinder 15. The degree by which valve 39 opens changes as a function of the rate of movement of the suspension.

The fluid flows from reservoir 17 into cavity A through bypass channels 5 in body 3 of the compression valve and further upward through aperture 6, overcoming the resistance of inlet valve 7.

The resistance of the shock absorber in the rebound stroke is significantly higher than in the compression stroke, a result primarily of the selection of valve springs.

Correct operation of the shock absorber depends to a great extent on the level of fluid in it. If there is insufficient fluid, the operation of the shock absorber will be interrupted (idle strokes occur). If the fluid level is too high, the operation becomes stiff and the shock absorber may be damaged.

Maintenance. The mounting of the shock absorbers is checked during TO-1 (each 1,100-1,700 km of travel). During TO-2 (each 5,500-8,500 km of travel), checks are made for leakage of liquid from the reservoirs and, if necessary, nut 30 is tightened. This requires that the shock absorber be removed from the truck. To remove the shock absorber, turn the front wheels fully to one side, unscrew the nuts on the lower and upper connecting pins 45 and remove

the pins and rubber bushings 3 from the lugs. Before tightening nut 30, lower lug 1 is clamped in a vice and upper lug 28 is moved upward and downward, checking the evenness of the stroke and the presence of resistance to movement in both directions. After this, cover 18 is removed with a special wrench and nut 30 is tightened, applying a torque of 7-8 kgm.

If the oil leakage continues after tightening of the nut, the shock absorber must be dissembled (keeping it as clean as possible) in the following sequence: Remove thrust washer 32, upper rubber sealing ring 33, the clamp of glands 22 together with the upper rubber gland 29 and its clamp 26, felt gland 24 and rubber gland 31 of the shaft and the lower sealing ring 33. After this, remove shaft 16 together with piston 12 from operating cylinder 15, pouring out the oil trapped by the piston in the cylinder and reservoir; fasten the shaft in a vice by lug 28 and remove piston 12 from the shaft, together with the valve part. Then remove guide 35 from the shaft with bushing 19 and push out rubber ring 34.

All parts removed, as well as the body and operating cylinder must be washed in regular gasoline or kerosene and blown off with compressed air. The ends of the shock absorber must not be wiped off, since the apertures in them are quite small and may become plugged with fibers, and the presence

of fibers between parts may cause them to wear rapidly. After drying, the parts are carefully inspected.

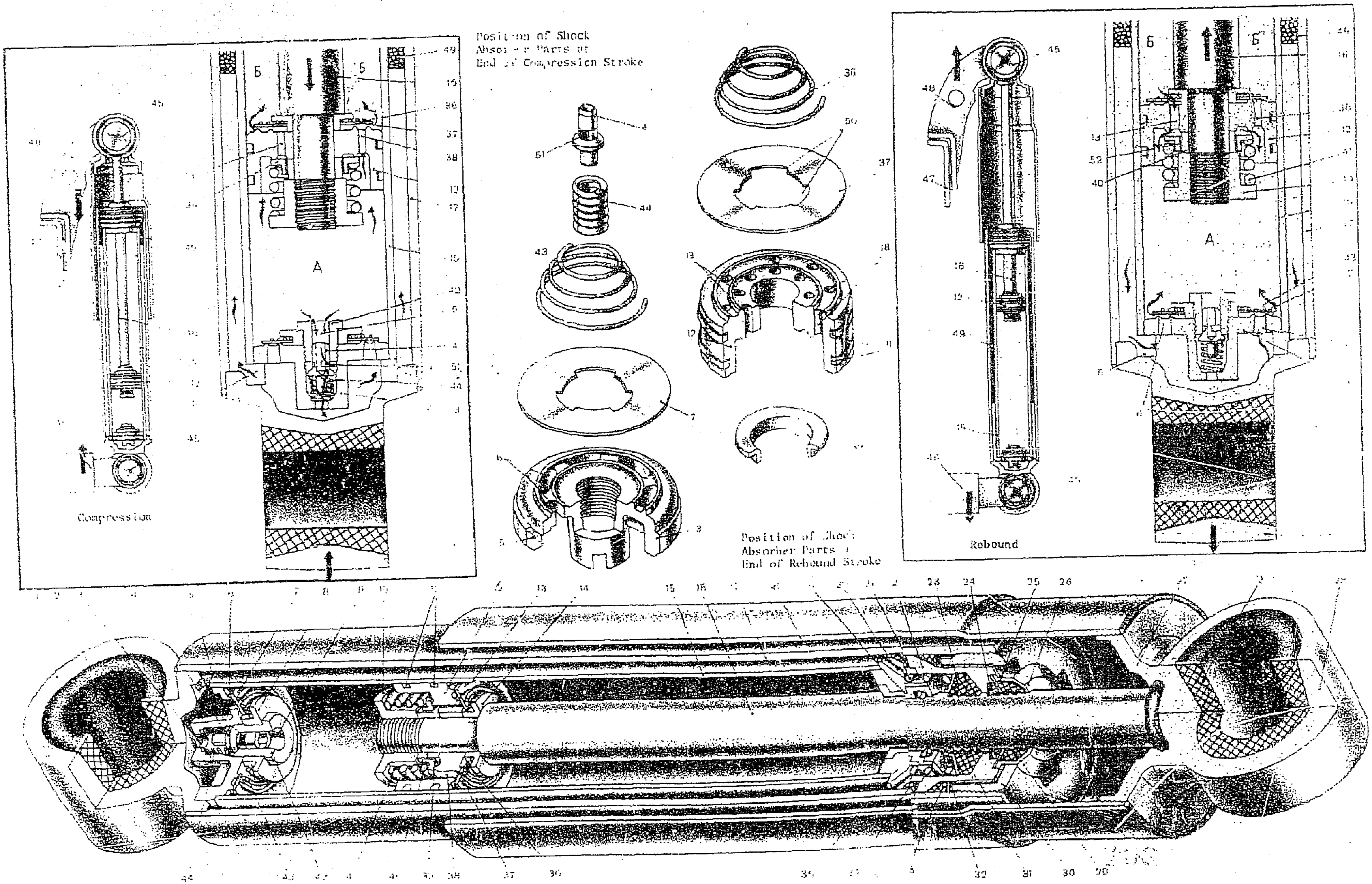
Rubber rings which are not circular in cross section and glands with worn internal surfaces at the shaft apertures are not suitable for use and must be replaced. The glands should be installed so that the inscription "bottom" on its end surface is turned toward the piston. The inner conical surface of the clamp 22 of the gland should be clean and without scratches, and the height of spring 21 should be at least 21 mm. If bushing 19 is greatly worn, guide 35 is replaced.

Before installing the gland in place, its inner surface should be lubricated with TsIATIM-201 high-temperature lubricant. When fluid is placed in the shock absorber, it is poured in the cylinder so that its level is 35-40 mm below the upper edge, and the remaining fluid is poured out into the reservoir. If the shock absorber does not present any significant resistance when tested by hand, it should be dissembled and a copper or aluminum bar 35-38 mm long should be used to tap body 3 of the compression valve out of operating cylinder 15. After this, the body is fastened in a vice, dissembled, washed and all its parts are checked.

The shock absorber fluid is changed once per year. The shock absorbers are then dissembled, carefully washed and checked.

1 - lower mounting lug of shock absorber
2 - rubber bushing
3 - compression valve body
4 - compression valve
5 - bypass channel
6 - channel for passage of liquid during rebound stroke
7 - intake valve
8 - intake valve limitor
9 - central bypass aperture for passage of liquid during compression stroke
10 - piston mounting nut
11 - piston compression rings
12 - shock absorber piston
13 - inner aperture for passage of fluid during rebound stroke
14 - bypass valve stroke limitor
15 - operating cylinder
16 - shock absorber shaft
17 - shock absorber reservoir
18 - shock absorber cover
19 - guide shaft bushing
20 - channel for passage of air and drainage of liquid
21 - shaft gland spring
22 - gland clamp
23 - rubber gland washer
27 - head of cover (together with lug and shaft)
28 - upper lug of shock absorber used for fastening to frame of vehicle
29 - upper rubber shaft gland
30 - reservoir nut
31 - main rubber shaft gland
32 - reservoir nut thrust washer
33 - rubber sealing ring
34 - rubber guide ring
35 - shaft guide
36 - bypass valve spring
37 - bypass valve
38 - outer aperture for passage of fluid during compression stroke
39 - rebound valve
40 - piston bushing
41 - rebound valve spring
42 - nut-seat of compression valve
43 - inlet valve plate spring
44 - compression valve spring
45 - connecting pin
46 - lower shock absorber mounting bracket
47 - vehicle longitudinal frame member
48 - upper shock absorber mounting bracket
49 - air cushion

24 - shaft felt gland
25 - upper shaft gland washer
26 - upper shaft gland clamp
50 - passages in bypass channel
51 - lateral bypass aperture
52 - circular slit



Position of Shock Absorber Parts at End of Compression Stroke
Compression
Rebound
Position of Shock Absorber Parts at End of Rebound Stroke
A
Б

Basic Data

Operating couple of steering mechanism -- globoid worm with 3-ridge roller
Transfer number of operating couple (average) -- 20.5
Steering column -- split, with two universal joints
Diameter of steering wheel -- 425 mm
Power steering unit capacity -- 0.5 l

Casing 43 of the steering mechanism is fastened by four bolts to the left longitudinal frame member. Within the casing is the operating couple of the steering mechanism, consisting of worm 41 and three-ridge roller 40, meshing with the worm.

The worm of the steering mechanism is made of alloy steel, pressed onto hollow shaft 32 and installed in the casing on two tapered roller bearings 51. The internal operating cavities of the bearings are the conical surfaces of the ends of the worm. Between lower cover 49 and the casing of the steering mechanism there are several paper shims 50, used to regulate the bearings of the worm. Beneath the cover of the upper bearing there is only one sealing gasket 53. Gland 52 is installed at the point where the worm shaft leaves the casing.

Roller 40 rotates on shaft 51 onto needle bearings 57, separated by spacer bushing 56. The shaft of the roller rides in seats in the head of shaft 47 of the pitman arm; the ends of the shaft are riveted by electrical riveting or welded by electric arc welding. Thrust washers 58 are installed between the ends of the roller and the journals of the shaft of the pitman arm. The roller has apertures for lubrication of the bearings.

The shaft of the pitman arm is mounted on two bearings: bronze bushing 48, pressed into the casing of the steering mechanism, and cylindrical roller bearing 35, set in side cover 34. Gland 44 seals the point where the shaft of the pitman arm leaves the casing. Pitman arm 45 is seated on the small tapered splines on the end of shaft 47; the pitman arm is tightly seated by tightening it with nut 46, which has a spring washer.

The correctness of angular placement of the pitman arm is assured by its four double splines, with the corresponding notches on the shaft. The rotation angle of the pitman arm shaft from the central position to either extreme position is 45°, which is limited by the contact of the rollers with depressions in the casing. When actually installed on the truck, the angle of rotation of the pitman arm is somewhat less (there is a reserve of pitman arm motion), since the maximum rotation of the steered wheels is determined by a stop in the ball mount of the limitor bolt, screwed into the body of the rotating cam of the front suspension.

The operating couple of the steering mechanism meshes with variable clearance. When the roller is in the position corresponding to driving in the straight line, the clearance in the mesh is practically zero. This lack

of clearance in the mesh when driving on a straight line allows the driver to "feel the road" well. As the wheel is turned in either direction and the roller approaches its extreme positions, the clearance gradually increases. If a clearance appears in the mesh with the roller in the position corresponding to driving in a straight line, it is necessary to adjust the worm couple. The worm is most strongly worn in the middle portion (corresponding to driving in a straight line), while its outer threads wear to a much lesser extent. If an increased clearance in the mesh were not provided at these points, adjustment of the mesh in the central portion of the worm would cause interference between the worm and the roller in the turned positions, and this interference in mesh would prevent automatic return of the wheel to the neutral position and would result in early failure of the worm couple.

Adjusting screw 37 is placed in the side cover of the steering mechanism casing for the purpose of adjusting the fit. The cylindrical tail of pitman arm shaft 47 fits into a special slot in screw 37. As screw 37 is turned, it moves together with roller 40 relative to worm 41. Since the axis of the roller is displaced relative to the plane passing through the axis of the worm and perpendicular to the axis of the pitman arm shaft by a distance corresponding to the limit of adjustment, when the steering pitman arm shaft

is moved, the distance between the shafts of the roller and arm changes, consequently changing the clearance. The adjusting screw is fixed in place by stop washer 38, pin 39 and nut 36, screwed onto screw 37.

Since the GAZ-66 engine is located beneath the cabin, which tilts forward together with the steering wheel to allow convenient access to the engine, the steering shaft includes universal joints. Steering column 14 is articulated to bracket 10 in the cabin of the truck by means of levers 9 and 12 and rubber bushings 59.

The hub of steering wheel 18 is fitted onto the splines of steering shaft 16, then held down tightly with a nut.

The steering mechanism drive consists of steering shaft 16 and drive shaft 7, connected together and to the shaft of worm 32 by universal joints. Steering shaft 16 is set in steering column 14 on two ball bearings 24. Axial movement of the shaft in the steering column is eliminated by means of adjusting washers 28, which are placed between the end of fork 29 of the universal joint and the lower bearing.

The shaft of worm 32 is connected to lower fork 4 of the steering shaft by means of a key.

Adjustment of the steering mechanism is required to eliminate excess clearance appearing in the mesh between the roller and worm, in the bearings of the worm and in the joints of the longitudinal steering arm. Excess clearance in these mechanisms cannot be tolerated from the standpoint of driving safety.

The most frequent reason for excess free play is clearance in the joints connecting the steering arms and the splined joint between the steering lever and its shaft. These clearances should therefore be eliminated first.

When adjusting the steering mechanism, it is first necessary to adjust the bearings of the worm. To determine whether there is a clearance in the bearings of the worm, it is necessary to disconnect the fork of the lower joint of the steering shaft from the worm shaft and the longitudinal steering arm from the pitman arm.

If there is a clearance in the bearings of the worm, the axial displacement of the worm shaft relative to the top cover of the steering mechanism case will be easily felt when the pitman arm is rocked.

The steering mechanism is adjusted in the following sequence:

loosen the bolts mounting lower cover 49 of the case and drain the oil;

remove lower cover 49 of the case and remove thin paper adjusting shim 50;

install the cover of the casing in place and check the longitudinal clearance in bearing 51 of the worm; if the clearance has not been eliminated, remove the thick gasket of the case cover, and replace it by a thin one;

after the clearance has been eliminated, check the force on the rim of the steering wheel 18 required to rotate it (tested with pitman arm shaft 47 out). The force should be between 0.3 and 0.5 kg.

The mesh of the worm with the roller is adjusted by adjusting the worm bearings. The clearance in the mesh is considered acceptable if the clearance at the lower end of pitman arm 45, with the wheels in the neutral position and the longitudinal steering arm disconnected, is not over 0.3 mm. This should be checked using an indicator. To adjust the mesh between the worm and the roller:

loosen cap nut 36 and remove stop washer 38;
rotate adjusting screw 37, using a hex-head wrench, in the clockwise direction until the clearance is eliminated, but so that the force required to turn steering wheel 18 is between 1.6 and 2.2 kg;
put on stop washer 38; if one of the holes in the stop washer does not match the keyhole, the adjusting screw can be rotated to achieve a match, as long as the force required to turn the steering wheel does not go beyond the limits just mentioned;
put on the cap nut and once more check the clearance at the end of the pitman arm;
place ball pin 55 into the aperture in pitman arm 45, tighten the nut and key it.

Maintenance. Correct operation of the steering mechanism is tested each day. During TO-1, the mounting of case 43 of the steering mechanism and tightness of nut 46 retaining the pitman arm are checked. During TO-2, the clearance in the steering shaft, mounting of the steering column and steering drive shaft parts are also tested. If there is clearance in steering shaft 16, adjusting washers 28 are removed. If the steering column is dissembled, the condition of the special high-temperature lubricant on bearings 24 should be checked. If there is insufficient lubricant or no lubricant, the bearings should be washed and lubricated with type TsIATIM-201 high-temperature grease. After adjustment, shaft 16 should rotate easily and have no axial clearance.

After checking the mountings of forks 4 and 29 of the steering shaft, the nuts on bolts 3 are tightened.

During TO-2, the presence of oil in casing 43 is also checked; the oil should be at the level of the filler hole, covered with plug 42.

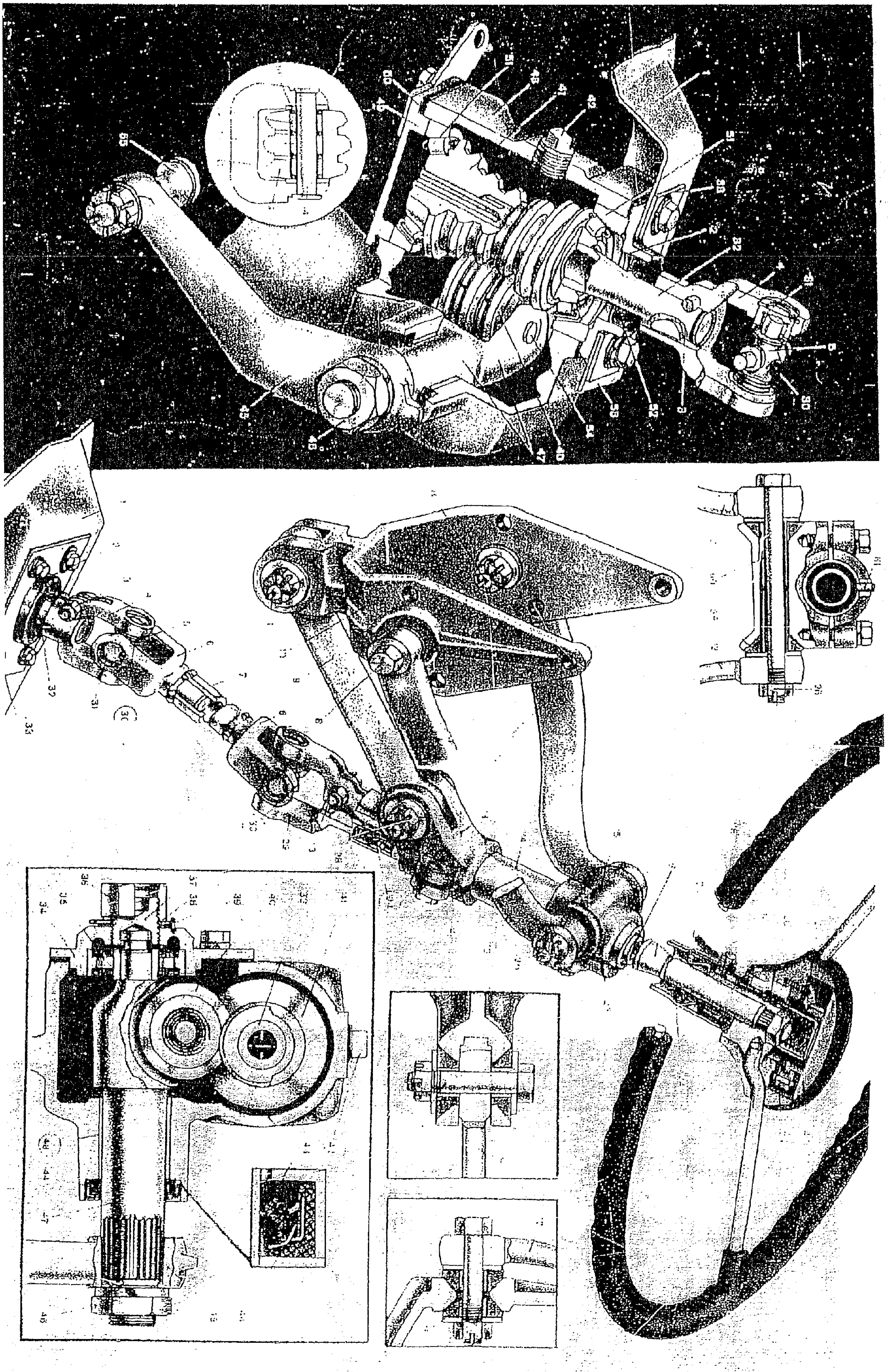
Twice per year during seasonal maintenance of the steering mechanism, the transmission oil in it is changed (in winter type TAp-10 is used, in summer -- TAp-15).

The needle bearings of the universal joint crosses are lubricated through oilers 30 with transmission oil as used in the transmission (TAp-10 in winter, TAp-15 in summer).

During TO-2, the clearances in the steering mechanism are checked and if necessary the mesh between worm 41 and roller 40 is adjusted, after first checking the condition of the parts of the steering mechanism. The condition of the parts is also tested during each dissembly of the steering mechanism for replacement of any part.

Excessive wear of worm and roller is not permitted, nor are scratches, dents or cracks involving separation of the hardened layer on the parts. If these defects are detected, the parts must be replaced. If roller 40 is to be replaced, its shaft 54 is drilled out; the new shaft is fastened to the pitman arm shaft by electric welding (on the side where the head was drilled out). The shaft of pitman arm 47 is replaced if the splines for installation of pitman arm 45 are damaged. Bronze bushing 48 of the pitman arm shaft is replaced by a new bushing in case of excessive wear, new bushing size 35 + 0.027 mm.

1 - floor panel fitting
2 - top cover of steering mechanism casing
3 - steering drive shaft tension bolt
4 - steering mechanism worm shaft fork
5 - universal joint cross
6 - drive shaft fork
7 - steering mechanism drive shaft
8 - axial bolt of upper lever
9 - lower lever of bracket
10 - steering column mounting bracket
11 - axial bolt of lower lever of bracket
12 - upper levers of bracket
13 - lower collar of steering column
14 - steering column
15 - upper collar of steering column
16 - steering shaft
17 - horn wire
18 - steering wheel
19 - contact ring
20 - contact fork
21 - contact plate
22 - horn button
23 - button holder
24 - steering shaft bearing
25 - upper collar cover
26 - upper collar axial bolt
27 - lower collar cover
28 - adjusting washers
29 - steering drive shaft fork
30 - cross bearing oiler
31 - cross bearing cup
32 - steering mechanism worm shaft
33 - fitting
34 - side cover of casing
35 - cylindrical roller bearing of pitman arm shaft
36 - adjusting screw nut
37 - adjusting screw
38 - adjusting screw stop washer
39 - adjusting screw washer stop key
40 - steering mechanism roller
41 - steering mechanism worm
42 - oil filler plug
43 - steering mechanism casing
44 - pitman arm shaft gland
45 - pitman arm
46 - pitman arm mounting nut
47 - pitman arm shaft
48 - pitman arm shaft bronze bushing
49 - lower cover of steering mechanism casing
50 - lower cover adjusting gaskets
51 - worm roller bearing
52 - worm shaft gland
53 - steering mechanism casing upper cover gasket
54 - steering mechanism roller shaft
55 - pitman arm ball pin
56 - spacer bushing on roller bearings
57 - steering mechanism roller needle bearing
58 - thrust disk
59 - conical rubber bushings
60 - spacer bushing
61 - steering column cover fixing key



Power Steering Pump

Basic Data

Type of pump -- hydraulic rotory blade, double acting high pressure oil pump
Oil delivery pressure -- at least 60 kg/cm^2 at 65-75°.
Maximum oil pressure -- 65-70 kg/cm^2
Pump delivery rate -- 8-10 l/min
Weight of pump -- 6.8 kg

Structure. The power steering oil pump of the GAZ-66 has been standardized with the power steering oil pump of the ZIL-130. The difference between the pumps is that the GAZ-66 uses a double drive pulley 22 and that the characteristics of spring 46 of bypass valve 8 are different.

The pump is driven by the pulley on the crankshaft of the engine through two drive belts 50.

Double pulley 22 is fastened to shaft 24 of the rotor by means of a slot and keyed nut 23 with a stop washer.

Shaft 24 is set in body 17 on needle bearing 16 and ball bearing 25; the ball bearing is permanently lubricated at the factory. In order to prevent entry of liquid oil from the pump body into bearing 25 and leakage of oil, the shaft carries gland 26 of oil-resistant rubber.

The splines of the cantilever end of shaft 24, extended out of body 17, carry rotor 12. The rotor has 10 slots, in which blades 17 ride freely. The rotor and blades move in stator 15. As shaft 24 rotates, blades 14 are pressed against the curved inner wall of the central aperture of the stator chamber by centrifugal force. Beneath the blades are slots 18, in which oil circulates, pressing the blades outward even more strongly.

Stator 15 is set between body 17 and cover 1 so that the direction of arrow 20 on the stator corresponds with the direction of rotation of the rotor shaft, when viewed from the end of pulley 22. Precise installation of stator 15 relative to the body is assured by two centering pins 13. Two apertures 21 for pins 13 and 6 channels 19 for bypassing of oil into the intake cavity are drilled in the stator. There are two circular sealing gaskets between body 17, stator 15 and cover 1, both made of oil-resistant rubber.

Cover 1 is fastened by four bolts 6 to body 17 of the pump. Within cover 1 of the pump is distributing disk 7, freely installed in the "hanging" position on the ends of pins 13.

The distributing disk is pressed against the stator when the pump is not operating by bypass valve 8 with its spring 46. When the pump operates at normal pressure, the disk is also pressed down by the oil in the delivery cavity of cover 1. If the oil pressure becomes excessive, when valve 8 moves away from the disk, the disk is held down only by the oil.

The end surfaces of body 17 and distributing disk 7 are carefully ground; there must be no scratches, nicks or gouges on these surfaces, the rotor, the rotor blades or the stator; these surfaces must also be free of deposits of oil oxidation products.

Distributing disk 7 contains: two channels 10 feeding the oil from delivery cavity 49 of the stator chamber to high pressure channel 3, two channels 9 and two apertures 11 feeding oil into slots 18 beneath blades 14 of the rotor, as well as the depressions for pins 13.

Cover 1 of the body contains calibrated aperture 5, 4.1 mm in diameter. It acts as a hydraulic resistance and creates a pressure drop which increases with increasing quantity of oil delivered. The calibrated aperture extends into high pressure channel 3, containing sealing seat 47.

There is an aperture in cover 1 for the nipple of the high pressure hose which feeds oil from the pump to the power steering control valve.

Cover 1 also carries bypass valve 8 and safety valve 43 with damped channels 2 and 44.

The pump carries tank 29, used as a reservoir for oil 51, which enters the pump through collector 28 and channel 27 and returns to the tank through channel 40 and tube 38. Collector 28 and tank 29 are fastened to the body and

cover with four bolts. The top of the tank is closed with cover 33 with its rubber gasket. The cover is fastened by a pin and wing nut with a rubber sealing ring and washer. The cover carries breather 31 connecting the tank to the atmosphere. The tank has screen filler filter 34.

Operation of the pump. The pump is a double acting device -- two intake and two delivery cycles occur with each rotation of the pump.

The oil from tank 29 passes through apertures 53 and channels 19 to fill the two intake cavities 39. As rotor 12 spins, its blades 14 are pressed outward by centrifugal force and the pressure of the oil in slots 18, and are pressed against the internal curved surfaces of the walls of stator chamber 15, creating low pressure in cavities 39, and the oil is drawn into the space between blades 48. As the blades move into delivery cavity 49, the volume of the space between blades decreases (the blades are forced into the slots in the rotor) and the oil is subjected to a pressure on the order of 60 kg/cm^2, after which, as the rotor turns still further, the oil is forced out through channels 10 in the distributor disk into high pressure line 3 and further through sealed seat 47 and the high pressure hose connected to it, into the distributor of the power steering booster. From the booster, the oil returns through tube 38 and filter 35 to tank 29. Continuity of oil feed is assured in case of plugging of filter 35 and an increase in pressure within the filter by plate-type safety valve 36, which opens when it overcomes the resistance of spring 37.

Since calibrated aperture 5 limits the rate of delivery of oil to cavity 52 of the bypass valve, when the pump is operating at 8-10 l/min the pressure difference across valve 8 increases and it moves to the right, compressing spring 46 and allowing the oil to pass through channel 40 into tank 29, which limits the maximum feed of oil as the engine speed increases. Due to the oil which is fed through the bypass channels into the intake cavities, the pressure in these cavities increases, decreasing the tendency of the oil to the formation of an emulsion and creation of noise as the pump operates. When the pressure developed by the pump exceeds 65-70 kg/cm^2, safety valve 43 opens. This decreases the pressure in cavity 52 and opens bypass valve 8 still further, increasing the oil feed through channel 40.

The noise resulting from operation of the pump increases when the oil level in the tank is too low, if the drive belts are too loose, if there is air in the system or if the pump parts are highly worn or scratched. When there is air in the system, the oil in the tank foams. If the rotor shaft bearings are badly worn, the drive belt pulleys rattle. The noise involved in pump operation, particularly at high engine speeds, is damped by collector 28, used to produce a gradual reduction in oil pressure arriving in the tank through bypass valve 8 and safety vavle 43. Furthermore, the inlet oil pressure is slightly increased, increasing the effectiveness of pump operation.

Maintenance. During the breakin period, it is recommended that tank 29 be filled with special type VNII NP-1 oil for hydraulic transmissions, GOST 10660-63. This oil can be used with air temperatures of no lower than -30°. To improve cleaning of the oil during the breakin period, it is recommended that an additional fiber filter be placed over screen filter 34 and held down

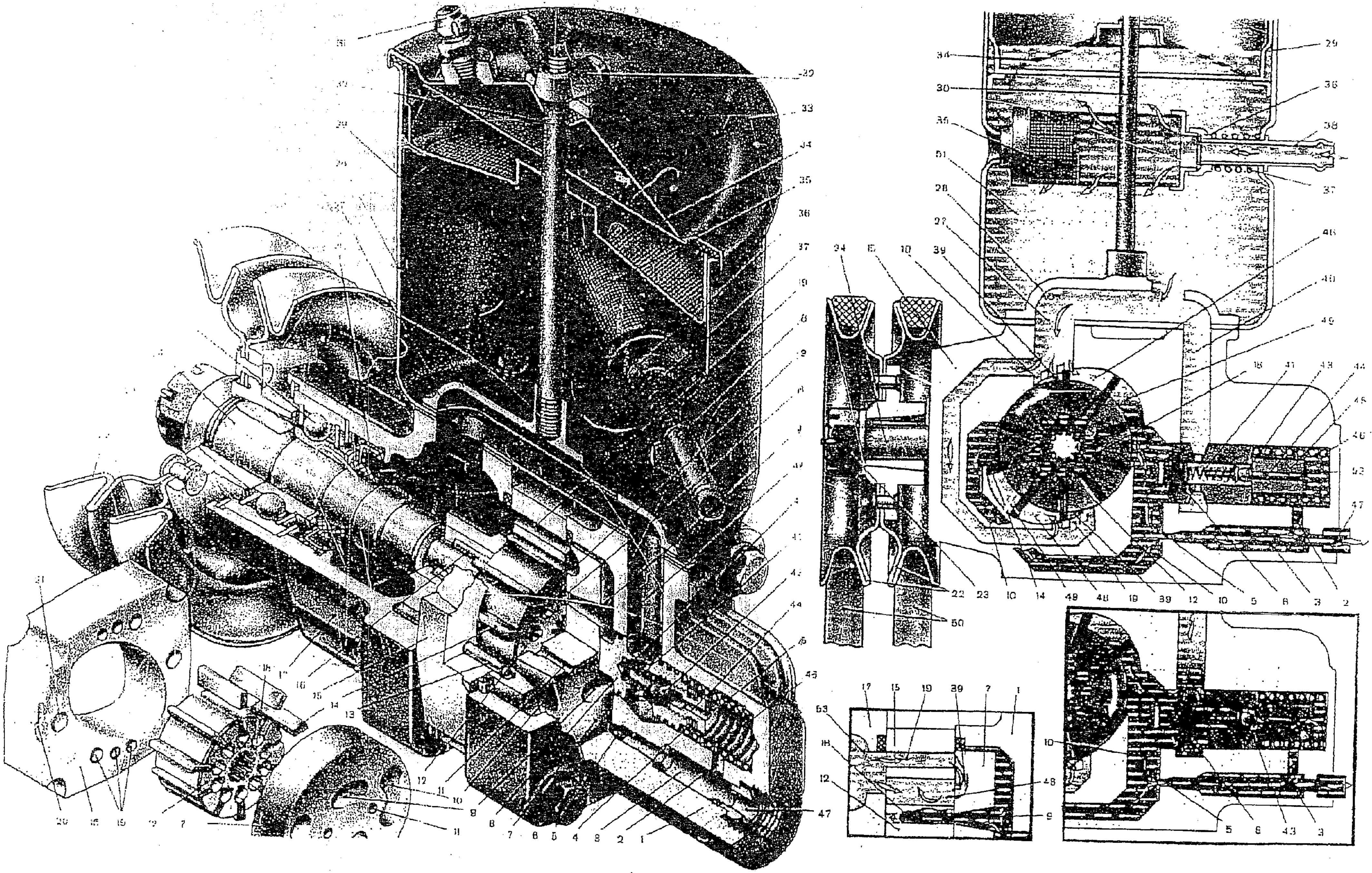
with two spring clips. After breakin, the fiber filter can be discarded. If this special oil is not available, the power steering system is filled in summer with type 22 turbine oil (GOST 32-53), in winter with type AU spindle oil (GOST 1642-50 or TU 1061). The capacity of the system is 1.8 l. During operation, at each TO-1 the oil level is checked and oil is added as necessary. Before removing cover 33, it is carefully cleaned; even slight contamination of the oil in the power steering system is forbidden, since they may result in a great increase in wear of the power steering mechanisms, as well as their failure. Oil of the same type as is already in the tank must always be used. Before adding oil, the wheels of the truck must be set in the position corresponding to straight driving, the engine is started and the oil is added (with the engine operating at idle) until it appears over screen filter 34. The oil should not completely cover the conical screen. It is recommended that a funnel with a double screen be used to filter the oil as it is added. During TO-1, the tension of drive belts 50 is also checked. It is considered normal if when the belt is pressed by a finger with a force of 4 kg at a point halfway between the pulleys, it is deflected by 15-20 mm. Belt tension is adjusted by the inclination of the pump. If

tilting the pump does not provide the required tension while allowing the normal oil level, the pump must be moved on the bracket; if the belt tension is too great, the pump bracket should be mounted on the supplementary holes provided.

During TO-2, screen filler filter 34 and circular filter 35 should be removed and washed with gasoline or solvent, and the attachment of the power steering hoses to the tank should be checked.

The oil is changed twice per year, and also after breakin. To drain the oil from the system, raise the front wheels of the truck, open cover 33 of the tank to let in air, disconnect the hoses between the pump and control valve, as well as the hoses from the nipples of the power cylinder. After the oil has drained, tank 29 and screen filters 34 and 35 are washed, then the hoses are replaced and fresh oil is poured into the system through the tank to wash out the booster. The engine is started and run at low speeds, and the steering wheel is turned fully to the left and to the right. The engine is then stopped and the washing oil is drained out, after which the system is filled with fresh oil, the engine is started once more and the steering wheel is rotated to be sure that the oil fills the entire system. After the engine is stopped, the oil is filled to the level of screen 34.

1 - pump cover
2 - damping channel of bypass valve
3 - high pressure channel feeding oil to booster
4 - adjusting washers
5 - calibrated aperture (4.1 mm in diameter)
6 - cover mounting tension bolt
7 - distributing disk of pump
8 - bypass valve
9 - channel (2) of distributor disk feeding oil into slots beneath rotor blade
10 - channel (2) of distributor disk feeding oil to high pressure channel
11 - aperture (2) in distributor disk feeding oil to spots beneath rotor blades
12 - pump rotor
13 - pin (2) centering stator and distributor disk relative to body
14 - pump rotor blade (10)
15 - pump stator
16 - needle bearing
17 - booster pump body
18 - rotor blade slot
19 - oil bypass channels to pump inlet
20 - stator setting mark
21 - aperture for centering pin
22 - double drive pulley
23 - pulley mounting nut
24 - pump rotor shaft
25 - permanently lubricated ball bearing
26 - gland of oil-resistant rubber
27 - channel (aperture) for passage of oil from tank to pump
28 - pump collector
29 - pump tank
30 - cover retaining pin
31 - breather connecting tank to atmosphere
32 - cover retaining wing nut
33 - tank cover
34 - filling screen filter of pump
35 - circular filter cleaning oil from booster
36 - plate-type safety valve
37 - plate valve spring
38 - tube for oil return from booster
39 - pump intake cavity (consisting of depressions on distributor disk
40 - channel for oil return
41 - ball safety valve spring
42 - valve guide spring
43 - ball safety valve
44 - safety valve damping channel
45 - safety valve seat
46 - bypass channel spring
47 - sealing seat
48 - space between blades in inlet area
49 - delivery cavity in stator chamber
50 - pump drive belts
51 - oil
52 - bypass valve cavity
53 - aperture in body for oil feed into space between blades



Power Steering Booster

Basic Data

Type of control valve -- slide valve, built into longitudinal steering arm.
Power cylinder -- separate, installed on front axle of vehicle and connected to transverse steering arm.
Nominal diameter of power cylinder -- 50 mm.
Cylinder stroke -- 159 mm.
Cylinder weight -- 4 kg.

The power steering booster decreases the force on the steering wheel necessary to turn the front wheels of the truck, and also absorbs impact loads arising as the wheels drive over irregular terrain. The force on the steering wheel required to turn the wheels when parked with the booster on is not over 20 kg.

Control valve and longitudinal steering arm. Body 62 of the control valve is made of foundry cast iron. The body carries four threaded apertures, into which the nipples of the oil lines are screwed. Oil is fed through channel 51 in body 62 from the pump, then leaves the system through channel 52 and returns to the pump tank; the other two channels are connected to lines 22 and 23, through which the oil is fed to the power cylinder and drained from the cylinder. Channel 52 carries body 53 of the ball back valve. There are three circular channels in the precisely finished internal surface of body 62, forming the delivery cavities 50 and 55 and drainage cavity 54. Within the body is steel valve 61, which has three bands. The outer bands of the valve each have two arbitrarily placed compensation channels 60, 0.9 mm in diameter. The surface of the valve is case hardened (depth of hardened layer 0.6-1.0 mm) and finished with great accuracy. The valve is asymmetrical, its outer end neck in gland 59 has a diameter of 10.2 mm, while the inner neck in gland 63 is 14.3 mm in diameter. Therefore, when assembling the body with the gland, the valve must be placed with its larger diameter neck in the body. The rear sides of glands 59 and 63 rest in aluminum support disks 58 and 64. The gland should move smoothly in the body, without seizing; before it is installed, the inner surface of the body and the outer surface of valve necks 61 are lubricated with oil type VNII NP-1 (GOST 10660-63).

Body 62 of the valve is placed in a strictly fixed position, for which a setting pin is pressed into the end surface of its flange, entering the center aperture on steel cross piece 65, which is fastened by two bolts 67 to the body of tip 45 of the longitudinal steering arm 40.

Valve 61 is connected by bolt 49 to nut 66 of cup 47. The cup and nut together with finger 68 of the pitman arm should move freely within tip 45 of the longitudinal steering arm. The total of these movements is 3 mm, determined by the permissible movement of the shoulder of nut 66 from the bottom of cross piece 65 to the end of tip 45.

Thus, valve 61 can also move relative to body 62 by its operating stroke, 3 ± 0.3 mm (from the middle position, 1.5 mm in each direction). The mutual

placement of the circular channels of the body and valve determines the direction of flow of the oil delivered by the pump (to the left or right cavity of the power cylinder or back to the pump tank).

Slide 61 of the control valve is connected to the steering mechanism through ball pin 68 of the pitman arm, which switches the valve. Ball pins 38 and 68 of the pitman arm are made of alloy steel (18 KhNT), precisely finished, carburized and hardened.

The spherical heads of the pins fit into apertures on the ends of longitudinal arm 40, and are clamped by springs 35 between thrust blocks 36. The springs are held in the compressed state by plug 32, screwed into arm 40 (on the rear end of the arm) and nut 66, screwed into cup 47 of the tip of the arm (on its front end). The plug of the rear joint is keyed, while nut 66 of the front joint is stopped by pin 48, which fits into two slots in cup 47 and into the aperture of nut 66. The springs prevent the formation of a gap in the ball joints of the longitudinal arm. To spring compression limitor 33 protects the springs from breakage. To lubricate the longitudinal

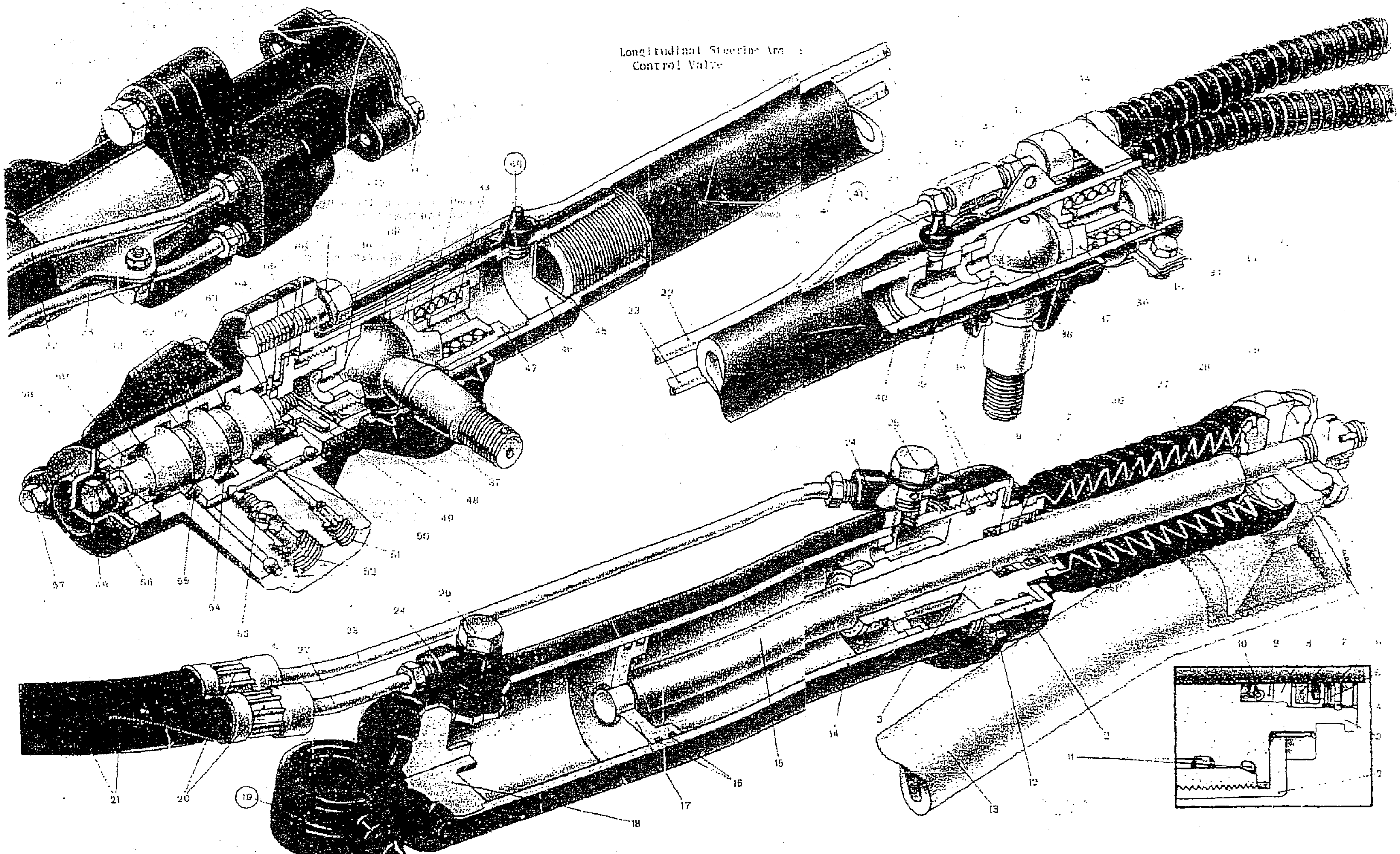
The cylinder is fastened by ball joint 18 to a bracket installed on the reducing drive of the front axle.

The ball joint consists of a ball pin and spherical thrust block surface, pressed into head 18 of the power cylinder. The ball pin rests on a supporting spot, compressed by a spring. The spring, which constantly presses the ball head of the pin against the spherical surface of the thrust block, eliminates the possibility of any clearance in the joint due to wear of parts. The spring rests against a washer held in place by a stop ring. The power cylinder joint is protected from dirt by steel spherical washers and a rubber ring. It is fastened to the axle bracket by a ball pin, the conical portion of which is tightened with a nut into the aperture of the bracket. Oiler 19 is provided for lubrication of the ball pin.

Maintenance. During TO-1, the mounting of the longitudinal steering arm pins and power cylinder of the booster is checked, as well as the mounting of the power cylinder bracket to the front axle; the front joint of the longitudinal steering arm is lubricated with type 1-13 lubricant (GOST 1631-61), and the rear joint is lubricated with type US-2 or US-1 lubricant (GOST 1033-51). The front joint of the longitudinal arm is lubricated with type 1-13 lubricant, since it is greatly heated by the control valve, through which the hot oil passes.

During TO-2, the longitudinal steering arm joints are adjusted and the mounting of the steering booster hoses is checked.

1 - bracket mounting booster shaft
2 to transverse steering arm
2 - head mounting nut
3 - power cylinder head
4 - stop ring
5 - outer thrust washer
6 - brass adjusting washer
7 - felt gland of shaft
8 - aluminum bushing
9 - rubber collar of gland
10 - gland spacer cup
11 - rubber sealing rings of head
12 - head mounting counter nut
13 - transverse steering arm
14 - power steering booster power cylinder
15 - power cylinder piston shaft
16 - cast iron piston rings
17 - power cylinder piston
18 - head of joint (tip) mounting power cylinder to front axle casing
19 - oiler for lubrication of ball pin of joint
20 - collars of rubber high pressure hoses
21 - rubber high pressure hoses (must withstand pressure of 140 kg/cm^2)
22 - tube feeding oil to power cylinder when truck turns left, draining oil when truck turns right
23 - tube feeding oil to power cylinder when truck turns right, draining oil when truck turns left
24 - connecting collar
25 - nipple bolt of connecting collar
26 - atmospheric aperture
27 - rubber shaft cover
28 - steel thrust disk of shaft
29 - rubber elastic bumpers of shaft
30 - nut mounting shaft to transverse steering arm bracket
31 - protective cover of rubber hose
32 - longitudinal steering arm plug
33 - spring compression limitor
34 - collar retaining bolt
35 - limitor spring
36 - thrust block of longitudinal steering arm joint
37 - ball pin protective cover
38 - rotating cam lever ball pin
39 - front joint stop
40 - longitudinal steering arm
41 - oiler for lubricating rear joint of longitudinal steering arm
42 - tube nipple
43 - connecting collar
44 - cover of hose collar mounting bracket
45 - body of longitudinal steering arm tip
46 - tip plug
47 - cup of longitudinal steering arm tip
48 - stop pin
49 - mounting bolt (travel limitor) of valve
50 - right (inner) delivery cavity of body
51 - channel feeding oil from booster pump
52 - channel draining (returning) oil to booster pump tank
53 - back valve body
54 - central drain cavity of body
55 - left (outer) delivery cavity of body
56 - control valve body cover
57 - cover mounting bolt
58 - front mounting washer of valve gland
59 - outer valve gland
60 - valve compensation channel
61 - control valve slide
62 - control valve body
63 - inner gland of valve
64 - rear supporting disk of valve gland
65 - valve body cross piece
66 - cup nut
67 - valve body mounting bolt
68 - steering mechanism pitman arm ball pin
69 - oiler for lubrication of front joint of longitudinal steering arm



Longitudinal Steering Arm Control Valve

Power Steering Booster Power Cylinder

220-a

Diagram of Operation of Power Steering Booster

Piston 31 of power cylinder 32 may move to the right, to the left or occupy a neutral position under the influence of the pressure of the oil filling the power steering booster. During turns, it moves shaft 33 and transverse steering arm 34, then through levers 28 and 35, it moves the hubs of steered wheels 27 and 36. When this occurs, the base of piston 31 of the cylinder, with a diameter of 50 mm, with an oil pressure 65-70 kg/cm^2, is acted upon by considerable force (exceeding 1,000 kg), which helps to turn the wheels and to overcome the resistance to turning the wheels in cross country driving.

Moving in a straight line. As the vehicle drives in a straight line, oil from pump 2 of the booster is fed through high pressure hose 3 to body 16 of the control valve. Slide 12 in body 16 of the valve is in the central (neutral) position, and its right delivery cavity 40 and left delivery 41 and neutral drain cavity 38 are connected through the gaps between dividing band 14 and bands 13 and 15 of the slide and body 16, and also through channels 8, 9, 10 and 11 in body 16. The oil from the body returns through hose 5 to tank 4 of the pump. The oil, flowing through compensation channel 37, fills the hydraulic reaction chambers 39 and 42, holding the valve in the neutral position, since the oil has identical pressure on the left and right of the outer ends of the plane of bands 13 and 15 of the slide. Since the hydraulic system of power cylinder 32, its lines 20 and 21, are already filled with oil, no further oil is forced into the cylinder or drained from the cylinder when driving in a straight line or upon completion of a turning motion. When the truck is being towed, when the engine is not operating, the oil does not circulate.

When steering wheel 24 is turned, steering mechanism 22 turns pitman arm 17. The pitman arm is connected to the longitudinal steering arm 25 through inserts 18 and cup 19. This cup is also connected to slide 12 of the control valve. When pitman arm 17 is turned, slide 12 can move relative to body 16 by 1.5 mm in either direction from its central position. Each band 13 and 15 of the slide has two compensation channels 37, 0.9 mm in diameter. The flow of oil as the valve moves through its channels 37 from cylinder chambers 39 and 42 to the central return cavity 38 and back assures smoothness of motion of the slide and prevents the slide from seizing. When longitudinal steering arm 25 and valve 12 move forward or backward, its bands shift to open the path for feeding oil under a pressure of 65-70 kg/cm^2 into power cylinder 32 of the booster and drainage of oil from this cylinder into tank 4 of the pump.

The distributing device, which connects the oil feed to the left or right cavity of the power cylinder, depending on the direction of the turn, assures the "tracking" action of the power steering, in that the pressure in the power cylinder and force on the transverse steering arm increase with increasing turning resistance of the truck. To move the control valve slide, a force is applied to it proportional to the oil pressure in the cylinder. This gives the driver the "feel of the road" and he senses the process of turning of the truck physically.

Control valve slide 12 constantly tends to occupy the middle (neutral) position, assuring that the wheels will return to the central position for driving in a straight line. The middle (neutral) position of the valve results from the presence of hydraulic reaction chambers 39 and 42: when it is moved to the left, the oil in hydraulic reaction chamber 39 is compressed, and rarefaction arises in chamber 42, forcing the valve to return to the neutral position.

When the truck is being towed with the engine off and a turn is made, or when the wheels are turned with the truck parked and the engine off, back valve 7 opens. The oil moves through drain channel 9 and through the aperture in back valve 7 into delivery channel 10 without returning to tank 4 of the pump (the rotor of which is not moving). This causes a significant increase in the force necessary to turn the truck and an increase in the free travel (play) in the steering wheel. The truck should only be moved with the power steering booster off for brief periods of time at low speeds. Back valve 7 also operates in case of a sharp turn of the steering wheel 24, since in this case the rapid movement of the piston in the power cylinder may cause a reduction in pressure in the delivery line, and the oil supply by the pump may not be sufficient to fill the spaces formed. When valve 7 opens, the oil moves along the shortest path from the left cavity 43 of the cylinder to right cavity 44 and back.

Turning of the truck to the right. When longitudinal steering arm 25 and pitman arm 17 move back, valve 12 is opened in the same direction and the oil from the pump travels along hose 3 into the right delivery cavity 40 of the control valve body.

From delivery cavity 40, the oil moves through line 21 to right cavity 44 of power cylinder 32 and moves piston 31 of the power cylinder to the left. The piston acts on transverse steering arm 34 through shaft 33, reinforcing the effort transmitted from longitudinal steering arm 25 through levers 26 and 28 onto arm 34. At the same time, as piston 31 moves, oil flows from left cavity 43 of cylinder 32 through line 20 to the central drain cavity 38 of the valve body and further through channel 9 and hose 5 into tank 4 of the pump.

Turning of the truck to the left. When longitudinal steering arm 25 and pitman arm 17 are moved forward, valve 12 also moves in this same direction; the oil from the pump moves through hose 3 and delivery channel 10 into the left delivery cavity 41 of the control valve body.

From delivery cavity 41, the oil moves through line 20 to left cavity 43 of power cylinder 32 and moves piston 31 of the power cylinder to the right.

Dissembly of units of power steering booster and replacement of parts. Periodically, and also in case of a defect or interruption in operation, the main units of the system should be dissembled, the parts washed and replaced if necessary.

Before dissembly of the booster pump, it is removed from the truck, after draining the oil from it, after which its outer surface must be carefully cleaned. During dissembly, checks are made to see whether the bypass valve in the cover moves easily and whether the valve seat is well tightened. If necessary, scratches are removed or the valve and cover are replaced.

When there are scratches or traces of wear on the end surfaces of the rotor, body or distributor disk, they are ground on a plate. If the blades are worn or seized, the entire set, consisting of the rotor, blades and stator, is replaced. When the pump is dissembled, all cavities and channels are washed out, and all channels and calibrated apertures are checked for cleanliness and good condition.

The pump pulley, shaft and its bearings are removed from the pump body only when absolutely necessary. When the pump is dissembled, the mutual positions of the distributor disk and stator, stator and pump body should be mounted, so as to return them to the same place according to the marks in assembly The splined aperture of the rotor has a face which should be turned toward the pump body. Individual parts of the set consisting of stator, rotor and blades should not be changed, nor should the cover and bypass vavle. All operations requiring dissembly of the pump should be performed by a qualified mechanic under very clean conditions. The torque applied to the bolts retaining the pump cover and the bolts retaining the collector and tank to the pump body should be 2.1-2.8 kgm and 0.8-1 kgm respectively. To tighten the nuts mounting the pump drive pulley, a torque of 5-6.6 kgm should be applied. Deposits of oil oxidation products, abrasives, fibers from cleaning materials and dirt in the control valve may cause failures in the operation of the booster which are dangerous for life and property. The control valve is periodically dissembled and washed.

Following dissembly of the control valve, the condition of the valve and body, condition of the valve glands and bronze seats of nipples for connection of oil pump tubing are checked. When necessary, the valve or body should be replaced. The body and slide are divided into three dimensional groups at the factory on the basis of diameter of the slide aperture and outer diameter of the slide. The clearance in the joint between the body and slide in the first group should be 0.003-0.013 mm. Parts from different sets cannot be used. The number of the dimensional group is stamped on the body and on the non-working neck of the slide. The control valve body must be tested for leaks before assembly, then the entire unit is tested for leaks after installation of the slide in assembled form, using hydraulic transmission oil type VNII NP-1 (GOST 10660-63), supplied for 2-3 minutes at a pressure of 80 kg/cm^2, while setting the slide in various positions.

Before assembly, the parts are washed carefully in gasoline and abundantly lubricated with oil of the same type used in the pump. When the slide is installed on the front steering arm, it is necessary to tighten the central mounting bolt so that the slide is not pressed in the valve body and the pitman arm pin moves freely together with the slide within the limits of the operating stroke of the slide (3 ± 0.3 mm). Defective slide glands must be changed. If the edges are dented or if there is significant wear or corrosion of the bronze seats of the tube nipples, they must be replaced.

The seal of the shaft and head of the power cylinder should be systematically checked, and oil leakage through them should not be allowed. The shaft seals can be adjusted by replacing the gland adjustment washers. In case of damage to the rubber sealing rings of the power cylinder head, or the felt gland and rubber collar of the shaft, they are replaced. In order to eliminate

leaks in the joint between the head mounting nut, head and cylinder, the nut and its counter nut are periodically tightened.

The power cylinder should be periodically dissembled and its internal cavity, piston, piston rings and shaft washed (the elasticity of the cast iron piston rings should be checked at this time), and the condition of the rubber seal, elastic shaft bumpers and rubber protective covers of the longitudinal steering arm ball pins should be checked.

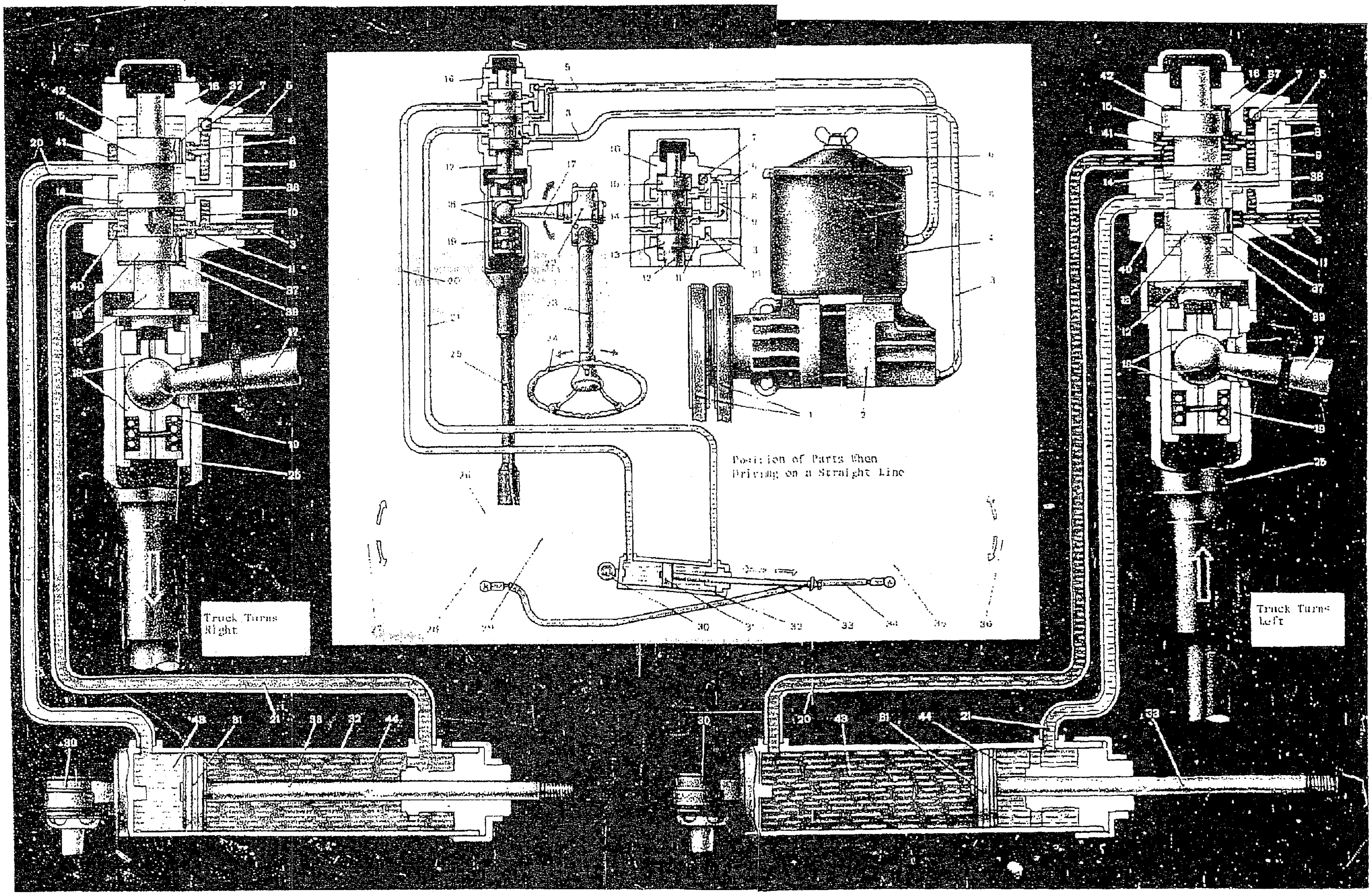
The hydraulic drive system of the booster uses high pressure hoses, low pressure drain hoses and steel tubing.

The high pressure rubber hoses consist of a protective oil-resistant cover, designed to operate in the temperature range from -45° to +100°, a rubber-fabric oil-resistant high pressure cover, designed to operate at pressures up to 75 kg/cm^2 with temperatures down to -50°, and steel tube tips with special nipples. The assembled hose is tested under pressures of up to 140 kg/cm^2, and is tensile tested under a load of 150 kg, and must pass the test without cracks or damage to the hose fittings in the nipples.

The drain hoses are rubber-fabric oil-resistant hoses; they are designed to operate at pressures of up to 5 kg/cm^2, at temperatures from -50° to +130°.

The approximate service life of the high and low pressure hoses is 40,000 km.

1 - pump drive belts
2 - pump body
3 - high pressure hose feeding oil from pump to control valve
4 - pump tank
5 - low pressure hose for drainage of oil from control valve to pump tank
6 - cover of pump tank
7 - back valve
8 - channel draining and feeding oil to and from left delivery cavity
9 - channel draining oil from valve body'
10 - delivery channel for feeding oil to left (outer) delivery cavity of valve body
11 - channel draining and feeding oil from right delivery cavity
12 - control valve slide
13 - valve band for right turns
14 - separating band of valve
15 - valve band for left turns
16 - control valve body
17 - pitman arm
18 - longitudinal steering arm joint bushings
19 - longitudinal steering arm tip cup
20 - line feeding oil to booster when truck turns left and draining oil when truck turns right
21 - line feeding oil to booster when truck turns right and draining oil when trucks turns left
22 - steering mechanism
23 - steering column
24 - steering wheel
25 - longitudinal steering arm
26 - upper lever of left rotating cam
27 - hub of left front steered wheel
28 - left (lower) rotating lever of transverse steering arm
29 - front axle
30 - hinge mounting power cylinder of booster to axle casing
31 - power cylinder piston
32 - power cylinder of power steering booster
33 - power cylinder shaft
34 - transverse steering arm
35 - right (lower) rotating lever of transverse steering arm
36 - hub of right front wheel
37 - compensation channel of slide valve
38 - central drain cavity of valve body
39 - right (inner) hydraulic reaction chamber of valve body
40 - right (inner) delivery cavity of valve body
41 - left (outer) delivery cavity of valve body
42 - left (outer) hydraulic reaction chamber of valve body
43 - left cylinder cavity
44 - right cylinder cavity


Truck Turns Right
Position of Parts When Driving on a Straight Line
Truck Turns Left

227 227-a

Brakes. Drive Units

Basic Data

Braking distance of loaded truck on dry asphalt highway (30 km/hr) -- not over 8 m.
Maximum slope on which truck can be held by foot brakes -- up to 30°.
Free travel of brake pedal -- 8-13 mm.
Capacity of hydraulic foot brake drive system -- 0.75 l.
Brake fluid used -- type GTZh-22.
Basic dimensions of parts: master cylinder diameter -- 32 mm; wheel cylinder diameter -- 35 mm; booster cylinder -- 22 mm; cylinder of booster control valve -- 12.5 mm.

The GAZ-66 has two types of brakes: the main drum brakes installed on all four wheels, controlled by a foot pedal and the hand parking brake, with a drum on the transfer box.

The drive from the foot pedal to the main wheel brakes is hydraulic, with a vacuum booster.

The hydraulic drive system of the brakes consists of brake pedal 95 and its drive, the master cylinder, the vacuum brake booster, the wheel cylinders and lines. Special type GTZh-22 brake fluid (TU MKhP 3759-53) operates satisfactorily under high and low temperature conditions.

The master cylinder is made in a single casting with the master cylinder of the clutch, including a common reservoir 64 for the fluid. Above the reservoir is cover 65 with a fluid filler aperture closed by plug 66. The master cylinder cavity is connected to the atmosphere through an aperture in nipple 68, used to flush out the clutch drive system.

Cylinder 82 contains piston 83, with two sealing collars 80 and 84, delivery valve 76 and inlet (back) valve 72. Between the piston and internal collar 80 is thin steel washer 60 of the piston.

Return spring 79 holds the master cylinder piston and its sealing collars in the extreme rearward position. The opposite end of the spring presses against the seat of back valve 72.

The cylinder is connected to the fluid reservoir through two apertures: compensation aperture 61, 6 mm in diameter, connects section 71 of the reservoir to the non-working cavity of the cylinder, enclosed between outer sealing collar 84 and inner sealing collar 80.

Bypass aperture 62, 0.7 mm in diameter, connects the reservoir to the operating cavity, located in front of inner sealing collar 80.

The cylinder is protected from dust, moisture and dirt on the pusher end by rubber cap 86.

The vacuum booster is used to decrease the force on the brake pedal, allowing rapid stopping of the truck when fully loaded and making the work

of the driver easier. The action of the booster is based on the use of the rarefaction formed in the intake manifold as the engine operates; using the energy of this rarefaction, the booster creates additional pressure in the brake hydraulic drive system. The rarefaction is transmitted to the vacuum booster from the intake manifold of the engine through tube 58 and through a blocking valve, consisting of body 54, cover 53 and plate-type valve 55 with its spring.

The vacuum brake booster consists of the booster chamber, cylinder and control valve.

The chamber of the booster consists of two stamped plate parts: body 1 and its cover 4, between which is diaphragm 3. Piston 38 is rigidly connected to pusher 12 at the center of the diaphragm. The chamber contains spiral spring 2, which presses the diaphragm toward the cover of the body. The right cavity of the chamber is connected by tube 48 through the blocking valve to the intake manifold of the engine.

Cylinder 36 of the booster is cast. Within the cylinder is piston 38 with sealing collar 28. The piston contains ball valve 31 with spring 42. The piston is connected to pusher 12 by pin 39. The slot in the piston contains plate pusher 27, which can move to a limited extent relative to the piston in the axial direction.

The necessary sealing of pusher 12 is achieved by two collars 45 and two sealing rings 7.

Thrust washer 44, limiting the travel of the piston to the rear, is contained between the cylinder of the booster and the body of the seals.

Body 15 of the control valve is fastened to the top of the body of the cylinder. The diaphragm of valve 18 is pressed between bodies 14 and 15. Spring 23 of valve 25 constantly attempts to press the valve against body 14. The cylinder of piston 22 of the control valve is connected to the main cavity of cylinder 36 of the booster; this piston is sealed with two collars 26. Within the body of the control valve is vacuum valve 21 and air valve 18, pressed downard by spring 19.

The cavity in the valve body beneath diaphragm 17 is connected to the cavity in body 1 of the booster chamber by rubber hose 90.

The body of the booster cylinder has four apertures: two four flushing the brake system with bypass valves 29 and 33 screwed into them, and two for connection of nipple 40 of the line from the master cylinder and nipple 34 of the line to the wheel cylinders.

Adjustment of the brake drive consists in setting the proper clearance between pusher 87 and the internal cavity of piston 83 of master cylinder 82. The clearance should be 1.5-2.5 mm, corresponding to a free pedal travel of brake pedal 95 of 8-13 mm. This clearnace is necessary to assure return of the master cylinder piston to its initial position when the brake pedal is released. The piston should rest against cap 85 and should not cover bypass

aperture 62 of the master cylinder with its inner collar 80. When this clearance is not provided, the wheels will be constantly braked, which may also occur if bypass aperture 62 is plugged, if rubber collar 80 is swollen, or if piston 83 of the master cylinder or piston 22 of the control valve becomes stuck. The free travel of the brake pedal and operation of the brakes are checked during TO-1.

The free travel of the brake pedal is adjusted with eccentric bolt 93, using which pusher 87 is connected to intermediate drive lever 94.

Care of the brake drive system consists in checking the level of brake fluid in the master cylinder during TO-1. Primary attention should be given to care of the hydraulic system, due to the corrosive nature of GTZh-22 brake fluid. Each second TO-1, the brake fluid must be drained, filtered and returned to the brake system.

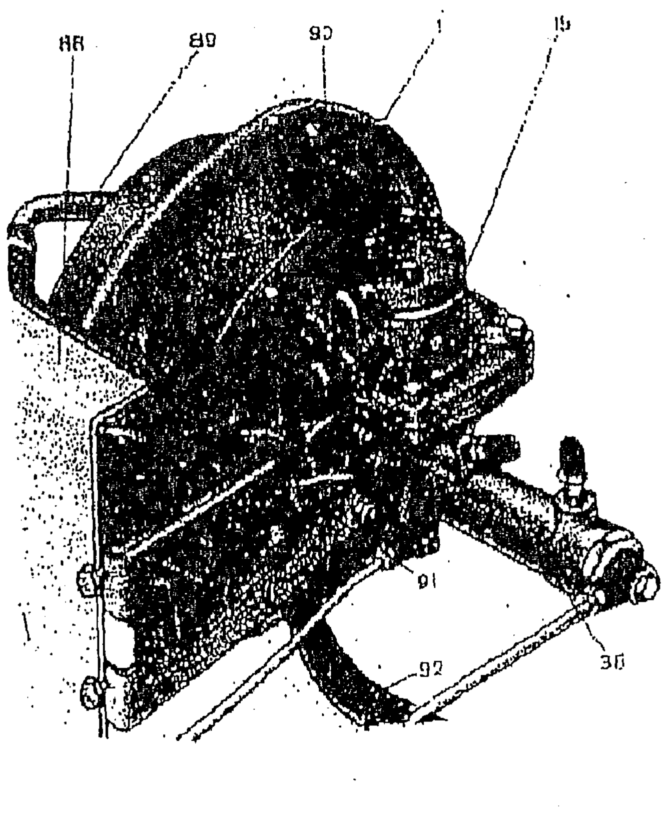
During TO-2 (but at least each six months), the system must be flushed out, all parts which contact brake fluid lubricated with castor oil, and fresh fluid poured into the system.

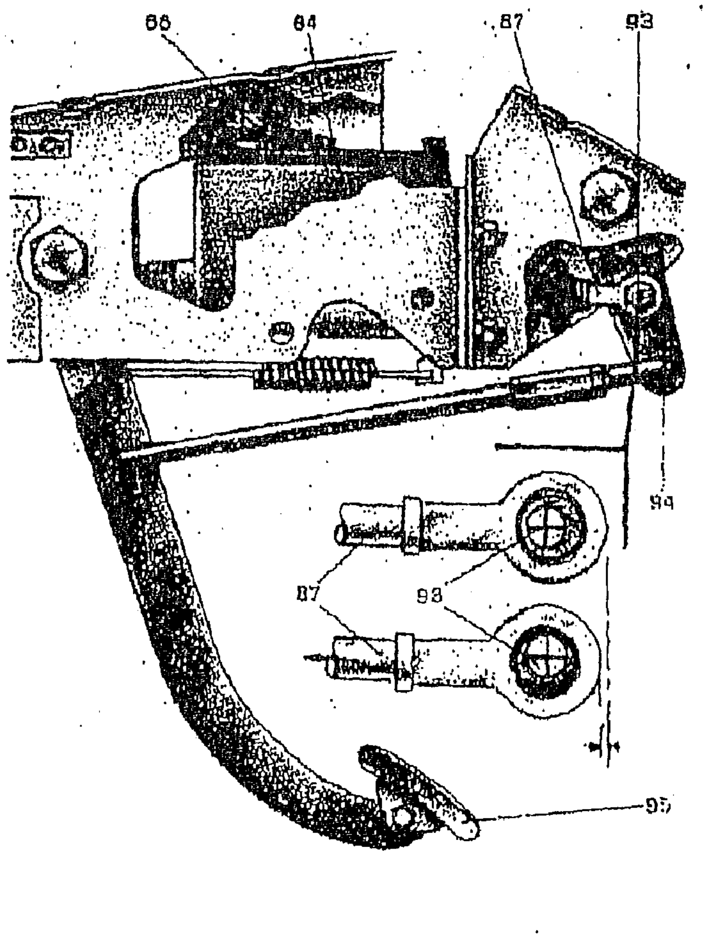
During TO-2, the mounting of the master cylinder and booster is checked and the entire brake system is tested for leaks.

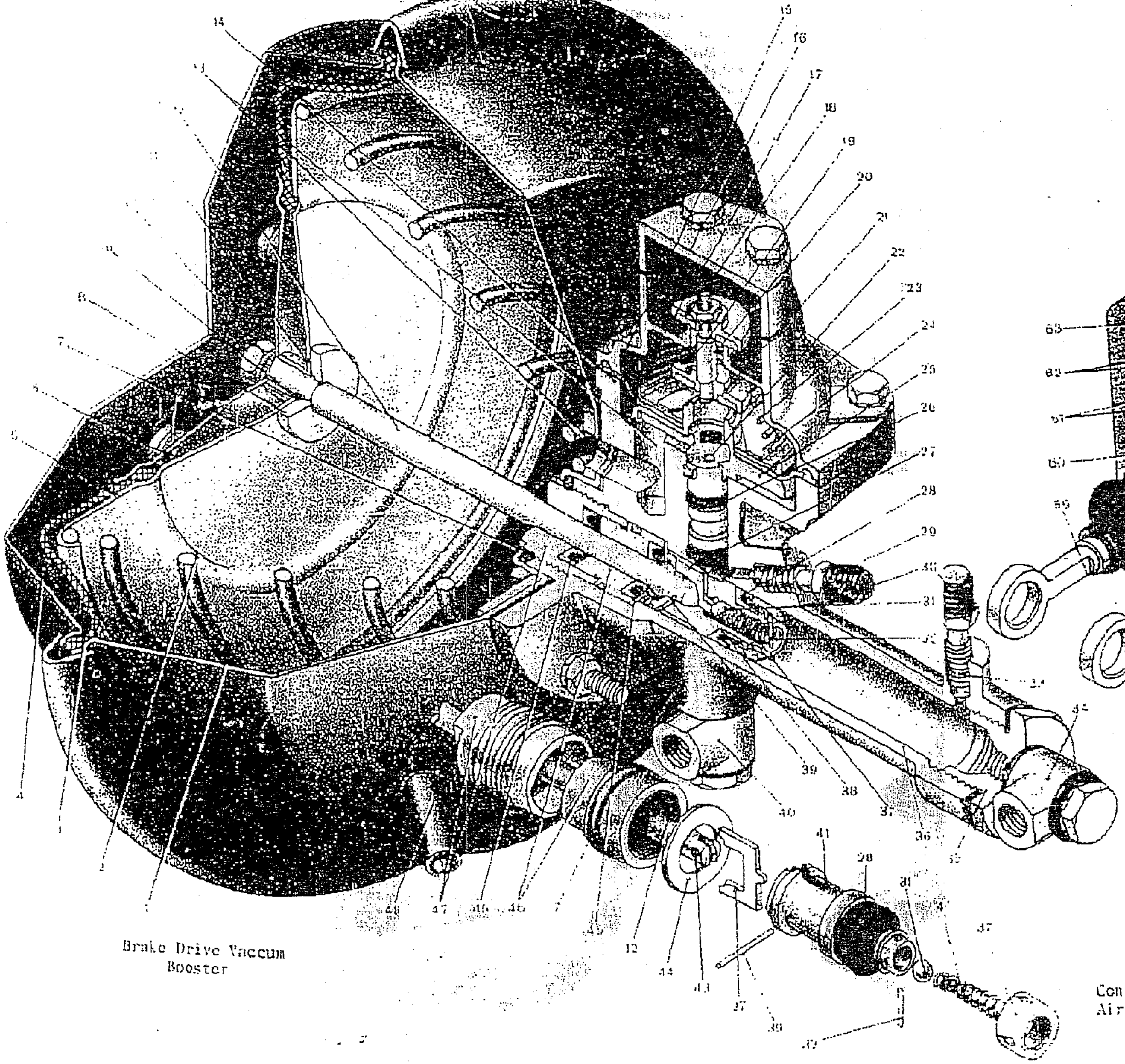
1 - booster chamber body
2 - booster diaphragm spring
3 - rubber booster diaphragm
4 - cover of chamber in body
5 - booster diaphragm plate
6 - booster diaphragm washer
7 - rubber sealing ring
8 - pusher washer
9 - sealing ring
10 - pusher nut
11 - spacer bushing
12 - booster cylinder piston pusher
13 - channels for transmission of rarefaction from booster chamber to control valve
14 - control valve piston body
15 - control valve body
16 - cover of valve body
17 - valve diaphragm
18 - air valve
19 - vacuum and air valve spring
20 - vacuum and air valve rod
21 - vacuum valve
22 - control valve piston
23 - control valve spring
24 - valve diaphragm washer
25 - control valve
26 - sealing collar of piston
27 - piston valve pusher
28 - piston collar
51 - air cleaner packing
52 - hose feeding air from air filter to control valve body cover
53 - stop valve body cover
54 - stop valve body
55 - stop valve
56 - aperture for connection of tube to intake manifold
57 - rubber diaphragm of stop valve
58 - tube for connection of back valve to hose from booster chamber body
59 - clutch master cylinder piston pusher
60 - piston washer
61 - compensation aperture
62 - bypass aperture
63 - reservoir barrier
64 - master cylinder case reservoir
65 - master cylinder case cover
66 - filler plug
67 - screen filter
68 - plug nipple
69 - reflector
70 - master cylinder reservoir clutch section
71 - brake master cylinder reservoir section
72 - back (inlet) valve
73 - nipple feeding brake fluid to

29 - control valve cylinder bypass valve
30 - rubber protective valve caps
31 - piston ball valve
32 - pin mounting piston collar cap
33 - cylinder bypass valve
34 - nipple feeding brake fluid to wheel cylinders
35 - booster cylinder plug
36 - booster cylinder
37 - piston collar cap
38 - booster cylinder piston
39 - valve pusher pin
40 - nipple feeding brake fluid from brake master cylinder
41 - slot in piston for piston valve pusher
42 - piston ball valve spring
43 - oval aperture in pusher
44 - piston thrust disk
45 - rubber collar of shaft
46 - vacuum booster cylinder seal body
47 - cylinder seal plug
48 - tube for hose transmitting rarefaction from intake manifold
49 - outer clamp of air cleaner
50 - inner clamp of air cleaner

booster cylinder
74 - brake light sender
75 - tube to booster cylinder
76 - exhaust valve
77 - exhaust valve spring
78 - exhaust valve spring supporting cup
79 - piston and back valve return spring
80 - internal sealing collar
81 - piston bypass aperture
82 - brake master cylinder
83 - piston of brake master cylinder
84 - outer sealing collar
85 - supporting cover
86 - protective caps
87 - pusher of brake master cylinder
88 - longitudinal frame member
89 - tube for transmission of rarefaction from control valve
90 - hose connecting outer cavity of booster chamber to control valve
91 - booster mounting bracket
92 - hose transmitting rarefaction from intake manifold of engine
93 - eccentric adjusting bolt
94 - intermediate drive lever
95 - brake pedal

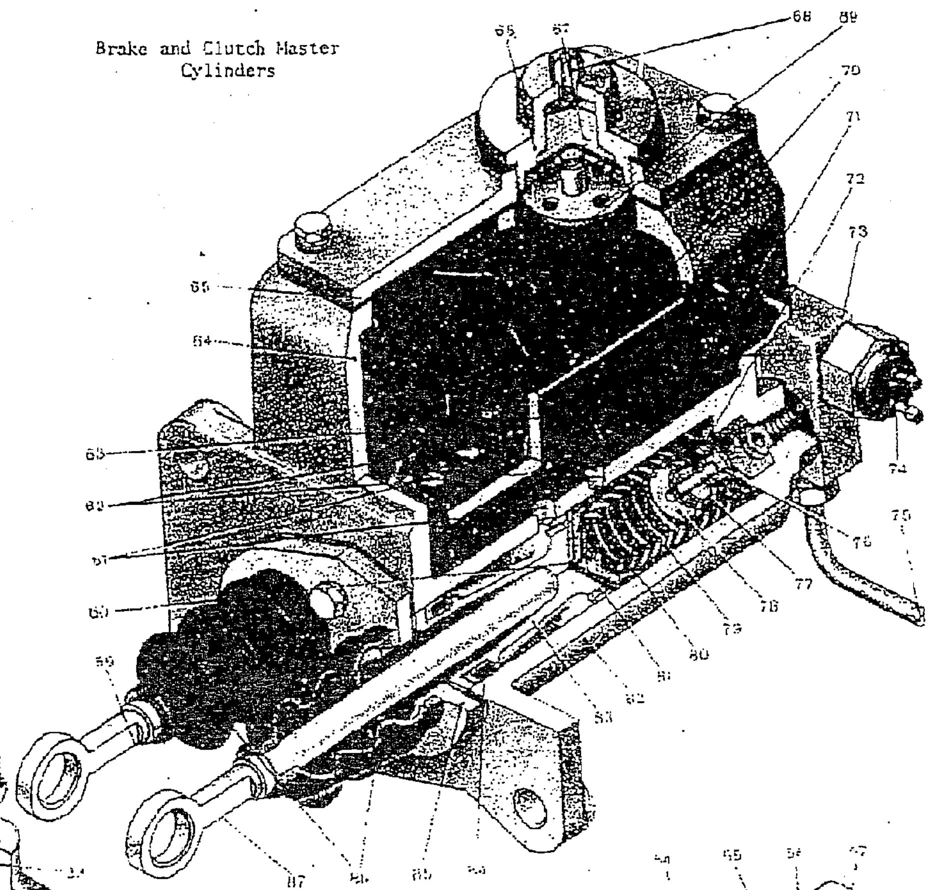


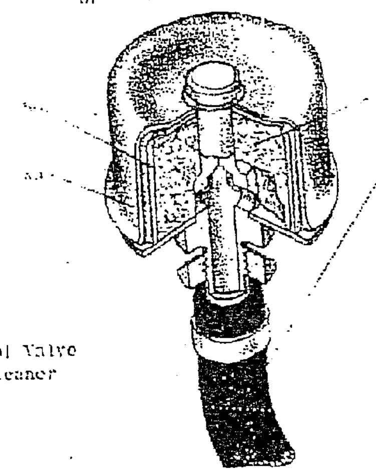




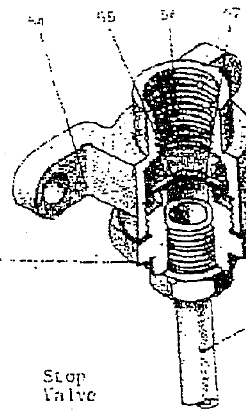
Brake Drive Vaccum Booster

Brake and Clutch Master Cylinders





Control Valve Air Cleaner



Stop Valve

Operating Diagram of Brake Drive System

When the brake pedal is depressed, pusher 9 moves piston 15, which covers compensation aperture 17. When piston 15 moves further within cylinder 10, the pressure increases, overcoming the force of the spring on exhaust valve 12, and the brake fluid flows from master cylinder 10 through the brake lines to cylinders 4, 7, 19, 20, 52 and 53 of the front and rear wheel brakes. This pressure causes pistons 6 of the wheel cylinders to move, pressing shoes 1, 5 and 50 against brake drums 3 and 48.

When the pressure is released from the pedal, the piston and pedal are returned to their initial position by the springs. The fluid from the wheel cylinders is forced back through the lines to the master cylinder by the pressure created by return springs 2 and 51, opening back (intake) valve 11. The pressure in the system drops smoothly. When the pressure drops to the extent that the return spring of the valve can overcome it, valve 11 is closed and fluid flow is stopped. This occurs at a pressure of 1.0-1.4 kg/cm^2. Thus, there is always some excess pressure in the brake system, keeping the collars in the wheel cylinders pressed tightly against the walls, avoiding leakage of fluid from these cylinders and preventing entry of air into the hydraulic system.

When the piston of the master cylinder moves back, the filling of the operating cavity with fluid lags behind the movement of the piston due to the resistance of the brake line and inlet valve; therefore, some rarefaction is created in the operating cavity. Under the influence of this rarefaction, fluid from the reservoir flows through compensation aperture 17 and the aperture in the head of piston 15 into the operating cavity of the cylinder, pressing back the steel washer and edge of the internal collar installed on the head of piston 15. The excess fluid in the operating cavity of the master cylinder, resulting from the arrival of more fluid under pressure from the system, flows into the master cylinder reservoir through bypass aperture 16. Thus, after each piston stroke, the operating cavity of the cylinder is always filled with fluid and the drive system is ready for repeated application of the brakes.

A constant volume of fluid in the hydraulic drive system is maintained by the master cylinder valves. When the pressure in the system increases due to expansion of the fluid resulting from heating, back valve 11 opens and the extra fluid passes through the operating cavity of the master cylinder and aperture 16 into reservoir 14. When the pressure drops, exhaust valve 12 opens and the fluid flows from the operating cavity of the cylinder, which it enters from the reservoir through bypass aperture 16.

If the brakes do not operate when the pedal is depressed, the pedal should be pumped 2 to 3 times. When this done, the master cylinder acts as a pump (due to the presence of the exhaust valve), pumping extra fluid into the wheel cylinders, at which point the brakes can be used.

When the engine is operating, the rarefaction in the intake manifold 48 causes the plate of stop valve 46 to rise, overcoming the force of its spring, and the intake tube is connected through hose 45 to the chamber of the vacuum

booster, cavity IV of which is under rarefaction. When the rarefaction decreases in the intake manifold (which may occur as the operating mode of the engine is changed or if the engine is stopped), stop valve 46 closes, retaining the rarefaction in cavity IV, sufficient for several effective stops.

When the pedal is not depressed and the engine is operating, the rarefaction from cavity IV is transmitted through channels 28 in the body of the valve to cavity II of the control valve and further through the central aperture of valve 37 to cavity I, from which it is transmitted through flexible hose 27 to cavity III of the booster chamber.

Thus, in cavities III and IV of the booster chamber, the air is under identical rarefaction, so that diaphragm 23 of the chamber is pressed by spring 22 into its initial position and piston 40 of the cylinder, connected by pusher 25 to diaphragm 23, is in its extreme left position, limited by the stop washer of plug 26. Plate pusher 42 of valve 39 is also pressed against the stop washer and its projection moves the ball of valve 39, connecting the cavity of cylinder 41 of the booster and master cylinder 10, aside. Since the pedal is not depressed and there is no pressure in the master cylinder, there is also no pressure in the booster cylinder -- the brakes are released.

When the pedal is depressed, the piston of the master cylinder creates pressure in the brake system. The fluid from the master cylinder passes through the aperture in piston 40 and enters wheel cylinders 4, 7, 19, 20, 52 and 53. At the same time, the fluid presses on piston 44 of control valve 37. If a force of 13 kg or less is applied to the brakes, the pressure throughout the entire hydraulic system is identical and equal to the pressure created by the master cylinder. When the pressure on the pedal exceeds 13 kg, the pressure in the master cylinder increases to the extent that valve 37 rises, overcoming the force of its spring 36. It then pushes against vacuum valve 33, closing its central aperture and opening air valve 32. This disconnects cavities I and IV.

When air valve 32 is open, air from the atmosphere passes in through air cleaner 34 to cavity I of the control valve and through flexible hose 27, filling cavity III of the chamber, decreasing the rarefaction in it; the rarefaction in cavity IV is retained. The pressure difference in cavities III and IV causes diaphragm 23 of the chamber, pusher 25 and piston 40 to move forward; the force of the spring on ball valve 39 closes the aperture in the piston, moving plate pusher 42 to the right and disconnecting the cavities of master cylinder 10 and booster cylinder 41.

Thus, two forces act on the piston of the booster cylinder: the pressure of the fluid from the master cylinder and the pressure transmitted by the pusher from the diaphragm of the booster chamber. Therefore, the pressure in the hydraulic system beyond the booster piston is considerably greater than that created by the master cylinder.

When air valve 32 is opened, the air filling cavity III of the chamber also presses on diaphragm 30 of the control valve. The air valve is closed as soon as the pressure in cavity III of the chamber and in cavity I of the booster increase to the point that the control valve diaphragm is pressed downward by the spring and the increased air pressure in cavity I, overcoming the pressure of the fluid on the control valve piston from below. To achieve a high boosting effect, the pressure in cavity III of the chamber must be increased, but this increases the pressure on the diaphragm of the control valve. In order to prevent the control valve from moving downward and prevent the air valve from closing, thus not interrupting the flow of air into cavity III of the booster chamber (causing increased pressure in it), it is necessary to increase the fluid pressure beneath the piston of the control valve, i.e., to increase the force on the brake pedal somewhat. In order to achieve a still greater boosting effect, the pressure on the pedal must be increased still more. Thus, the design of the booster increases the effectiveness of braking as a function of the pressure on the brake pedal.

When the brake pedal is released, the pressure in the master cylinder drops, control valve 37 moves downward, air valve 32 closes, vacuum valve 33 opens, the rarefaction from cavity IV is transmitted through valve 37 and hose 27 to cavity III of the chamber; diaphragm 23 of the chamber moves back under the influence of spring 22, along with pusher 25 and piston 40, ball valve 39 enters the seat in plate pusher 32, the aperture in the booster piston opens, and fluid from the wheel cylinders flows back to the master cylinder -- the brakes are released.

In case of a failure of the booster or if there is no rarefaction in the booster system, the brake system will operate, but higher pressure on the pedal will be required, and the braking distance is increased.

The brake pedal may rest against the floor of the cabin if the clearance between shoes 1, 5 or 50 and brake drums 3 or 49 becomes too great, due to improper adjustment of the shoes (after replacement of shoes or drum) or if there is air in the system.

If all brakes and the drive are properly adjusted and there is no air in the system, the brake pedal should not move over more than half its travel when pressed, after which the resistance of the pedal should be felt ("hard" pedal). If the pedal can be pushed almost all the way to the floor with slight resistance ("soft" pedal), this indicates that there is air in the system. The brake system must be bled to remove the air.

To do this, after unscrewing the plug of the filler aperture, fill reservoir 14 with brake fluid. Remove the rubber cap from the bypass valve on wheel cylinder 53 of the right rear wheel brake and replace it with a rubber hose, the other end of which is placed into a glass vessel of 0.5 l capacity,

half full of brake fluid. Then, after loosening the bypass valve by 1/2-3/4 turn, press the brake pedal down several times. This will cause the fluid, under the pressure of piston 15 of master cylinder 10, to fill the system, forcing out the air. Pump fluid through the master cylinder until no more air bubbles come out of the hose in the brake fluid. Fluid must be added to reservoir 14 as the system is bled, so that it does not become empty. After bleeding, tighten the bypass valve fully, remove the rubber hose and replace the rubber cap. The brakes are then bled in the following order: upper cylinder 19 of the right front brake, then lower cylinder 20 of the same brake, upper cylinder 7 of the left front brake, then lower cylinder 4 of the same brake, cylinder 52 of the left rear brake and cylinder 41 of the vacuum booster (through the two bypass valves 38).

After the brake system has been bled, fluid is added to reservoir 14 of the master cylinder so that its level is 15-20 mm below the upper edge of the filler aperture, and the filler plug is screwed on tight.

1 - upper brake shoe of front wheel brake
2 - front brake return spring
3 - front wheel brake drum
4 - lower cylinder of left front brake
5 - lower brake shoe of front wheel brake
6 - wheel cylinder piston
7 - upper cylinder of left front wheel brake
8 - front brake shoe shaft
9 - piston pusher
10 - brake master cylinder
11 - back (inlet) valve
12 - exhaust valve
13 - brake light sender
14 - brake and clutch master cylinder reservoir
15 - master cylinder piston
16 - bypass aperture (0.7 mm diameter)
17 - compensation aperture (6.0 mm diameter)
18 - intermediate brake drive lever from foot pedal
19 - upper right front wheel cylinder
20 - lower right front wheel cylinder
21 - vacuum booster chamber body
22 - booster diaphragm spring
23 - booster rubber diaphragm
24 - chamber body cover
25 - vacuum booster cylinder piston pusher
26 - cylinder seal plug
27 - hose connecting external cavity of booster chamber to control valve
28 - channel feeding rarefaction from internal cavity of booster chamber to control valve
29 - body of control valve
30 - valve diaphragm
31 - spring of vacuum and air valves
32 - air valve
33 - vacuum valve
34 - control valve air cleaner
35 - air cleaner packing
36 - control valve spring
37 - control valve
38 - bleeding bypass valves
39 - piston ball valve
40 - booster piston
41 - booster cylinder
42 - piston valve pusher
43 - oval aperture in pusher
44 - control valve piston
45 - hose transmitting rarefaction to booster chamber
46 - stop valve
47 - stop valve body
48 - intake manifold of engine
49 - rear wheel brake drum
50 - rear wheel brake shoe
51 - rear wheel brake return spring
52 - left rear wheel cylinder
53 - right rear wheel cylinder

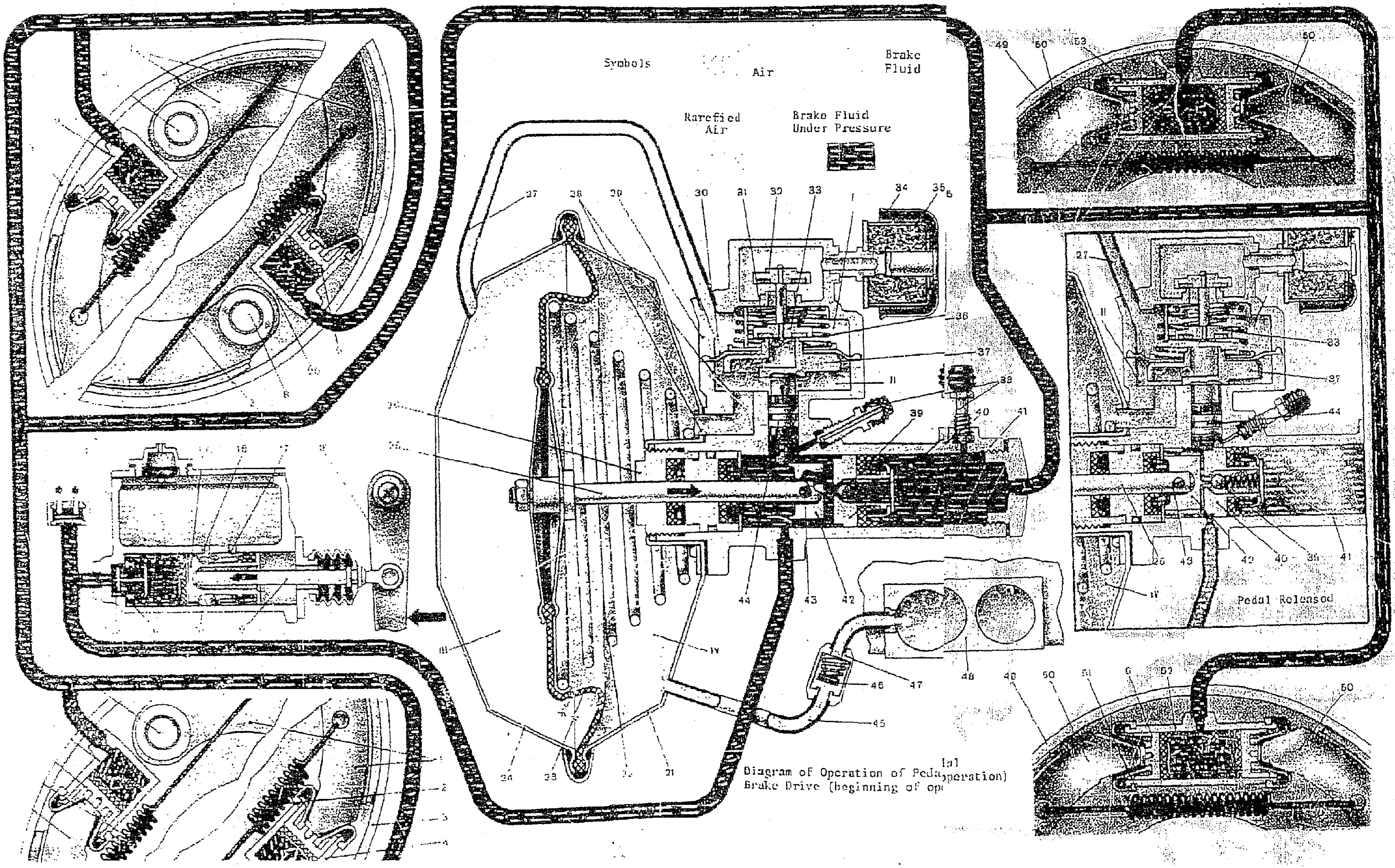


Diagram of Operation of Peda[l]
Brake Drive (beginning of op[eration])

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Main and Hand Brakes

Basic Data

Diameter of main brake drums -- 380 mm.
Width of liners of main brake shoes -- 80 mm.
Diameter of wheel cylinders -- 35 mm.
Diameter of hand brake drum -- 220 mm.
Width of hand brake friction liner -- 60 mm.

Main (wheel) brakes. The front and rear wheels of the truck carry drum-type brakes of different design. The front brakes carry individual wheel cylinders for each shoe, while the wheel brakes have one wheel cylinder for both shoes. This results from the necessity of increasing the effectiveness of the front brakes in comparison with the rear brakes, since during braking the weight of the truck is shifted forward onto the front wheels. The increased effectiveness of the front brakes, each shoe of which has its own cylinder, is explained by the fact that the twin leading shoe design thus allowed causes both brake shoes to be pressed against the cylinder by forces of friction. On the rear wheels, where there is only one cylinder, only one brake shoe experiences this wedging action.

Brake mounting disk 8 of the front brake is stamped of sheet steel. Centered and mounted on the journal of the rotating cam, it is the supporting disk for installation of brake shoes 21 and 23 by means of supporting pins 17 and wheel cylinders 9 and 22.

Supporting pin 17 carry bronze eccentrics 19 between washers 20 beneath their heads and supporting lug 18 of the wheel cylinder. Brake shoes 21 and 23 rotate on these eccentrics. By rotating pin 17 with eccentrics 19, the ends of the shoes can be displaced relative to the brake supporting disk, thus changing the clearance between the brake linings and drums. When the shoes are properly installed, with linings which are not worn and with a new brake drum, the installation marks on the end of the pins should be turned toward bolts 27 (the variation from this position should not exceed 40° in either direction).

The rim of the shoe and its rib are stamped and welded by electric welding. Brake lining 1 is fastened to the rim with brass rivets 2, sunken into the lining.

The moving ends of the brake shoes fit into slots in tips 6 of pistons 10 of the wheel cylinders. The ribs of the shoes rest on adjustable eccentrics 4, installed on the brake mounting disk. The eccentrics are held by strong springs which are compressed and rest against six-sided heads 24, to prevent accidental rotation. The shoes are pressed against the eccentrics by return springs 5.

Six-sided head 24 of the eccentric axis extends to the outside of brake mounting disk 8. The eccentrics are used to set the clearance required between the shoes and the drum.

The shoes are held against lateral movement by brackets 3, mounted on the brake mounting disk near the middle of the shoes. The brackets are equipped with plate springs.

Each brake drum consists of a cast iron rim and a sheet steel stamped disk. The disk is joined to the rim permanently during casting of the rim.

Within each wheel cylinder is piston 10 with rubber sealing collar 11. Spring 12 presses against the piston through a spacer cup. The spring and spacer cup press the edge of the collar against the inner face of the cylinder continually, assuring a good seal. The spring also presses the wheel cylinder piston against the end of the shoe rib.

The cylinder has two apertures. One is used for installation of hollow bolt 27 of connecting collar 25, through which the brake fluid is fed from the drive system, while the other end holds bypass valve 13, through which the air is released when the brakes are bled. When the valve is screwed down tight, the system is sealed, since its conical tip covers the aperture of the cylinder, while when it is backed off by 1/2-3/4 turn, this valve connects the cavity of the cylinder to the container (filled with brake fluid) into which the air is allowed to bubble from the system during bleeding. To prevent plugging of the aperture, the valve is covered with protective rubber

cap 14. Cylinders 9 and 22 of the front wheel are connected with each other and with the hydraulic brake drive system by tubes 26. The internal cavities of the wheel cylinders are protected from dirt by rubber caps 7.

The pistons, collars and other parts of cylinder 31 of the rear brake are the same as those of the front brake. In the lower portion of brake mounting disk 28 are supporting pins 35, which, just as in the front brakes, carry adjustable bronze eccentrics 19, on which the shoes are mounted. With proper installation of shoes with new, non-worn linings and drums, setting marks 65 on the pins should be turned toward each other. The permissible angular deviation from this position is not over 40° in either direction.

As the truck is used, the linings of the brake shoes are worn, the clearances between shoes and brake drums increase and brake pedal travel increases. In order to restore normal clearances and decrease the pedal travel, the brakes must be adjusted (each shoe). This is done by rotating the eccentric with the wheels jacked up until the wheel is braked to a stop; then the eccentric is gradually released until a position is reached in which the wheel begins to turn freely (without friction between drum and shoe).

Adjustment of the drums using supporting pins 17 and 35 is performed only during repair of the brakes, when the friction linings are reriveted or the shoes are replaced. The hand (central) brake is a drum type, installed on the transfer box. It is designed to hold the truck in place when parked and hold it on slopes. It can be used as a driving brake only under emergency conditions in case of failure of the main brakes.

Central brake mounting disk 58 is fastened by bolts to cover 55 of the transfer box. On the upper portion of the mounting disk, two bolts hold body 52 of the spreader mechanism, the aperture of which carries pushers 51. The pushers have cylindrical slots on their insides, turned at an angle to their axes; two balls 57, located in apertures of shaft 56, move in these slots during braking.

The lower portion of mounting panel 58 carries body 61 of the hand brake adjusting mechanism on two bolts. An aperture in the body carries floating supporting pins 42 of the brake shoes. Spreading thrust block 64 is mounted between the pins, with plate spring 63 of adjusting screw 62 in a slot in the block.

The ends of shoes 44 and 59 fit in the slots of pushers 51 and pins 42. They are pressed into the slots by return springs 38. Brake drum 47 is seated on the centering shoulder of flange 46 of the rear drive shaft and is fastened with four bolts. The brake drum is statically balanced; in order to decrease imbalance to the permissible quantity (40 cgm), balancing holes 43 are drilled in the rim of drum 47.

The central brake is driven from the cabin through a lever with a rod moving within a cover, and intermediate lever, articulated to a nonmoving bracket, and arm and lever 53. To apply the brake, it is necessary to lift upward on the brake lever; this rotates lever 53 through a system of levers and arms and, as the short arm of lever 53 presses against spreading shaft 56, the shaft is moved into the spreader mechanism. Balls 57 move pushers 51

and shoes 44 and 59 apart. The linings on the shoes press against the brake drum 47, braking the truck. The click stop on the lever, mating with the teeth on the brake drive rod, hold the hand brake in the braked position.

If the hand brake must be used as an operating brake, its effectiveness is higher when the truck is moving forward than when it is moving backward. This results from the fact that the return springs of primary shoe 44 are weaker than the return springs of secondary shoe 59, and also since due to this difference the spreading thrust block is pressed to the left against the stop in the body of the adjusting mechanism, so that a clearance of 3 mm is formed between the right side of the thrust block and the body in the nonbraked position.

During braking, when the truck moves forward, first shoe 44 contacts the drum first, is held by the drum and, moving in the direction of rotation of the drum, shifts secondary shoe 59 through its supports and the spreading thrust block. This shoe presses against the drum and is also caught by it. Partial wedging of both shoes thus occurs, from riding very effective braking.

When the truck is moving backward, only the secondary shoe 59 is caught by friction as it rests against the spreading thrust block, which cannot move to the left and act on primary shoe 44. Thus, primary shoe 44 is pressed against brake drum 47, but is not wedged; therefore, the braking effect is

somewhat less than when the truck drives forward. The return springs are painted different colors: the weak springs are red, the stronger springs are black.

To protect it from dirt and oil, the brake is equipped with reflector 49. Oil reflector 48 is installed beneath the brake mounting disk mounting bolts, preventing oil from the transfer box from reaching the friction linings.

As the friction linings wear, the clearance between the shoes and brake drum can be restored by rotating adjusting screw 62, which acts on spreader block 64 and moves the shoes apart. There are 12 slanted slots on the end of the inner head of adjusting screw 62, into which the ends of flat spring 63, which fixes the screw, can fit. The spring cannot rotate with respect to the spreader block 64, since its central portion fits into the longitudinal slot of the block. As the adjusting screw is rotated, the ends of the flat spring bend, moving outward along the tilted edges of the slots on the end of the screw and move into the next slots, thus fixing the position of the screw each 1/12 turn (clicks are heard, the number of which indicates the amount of tightening of the shoes).

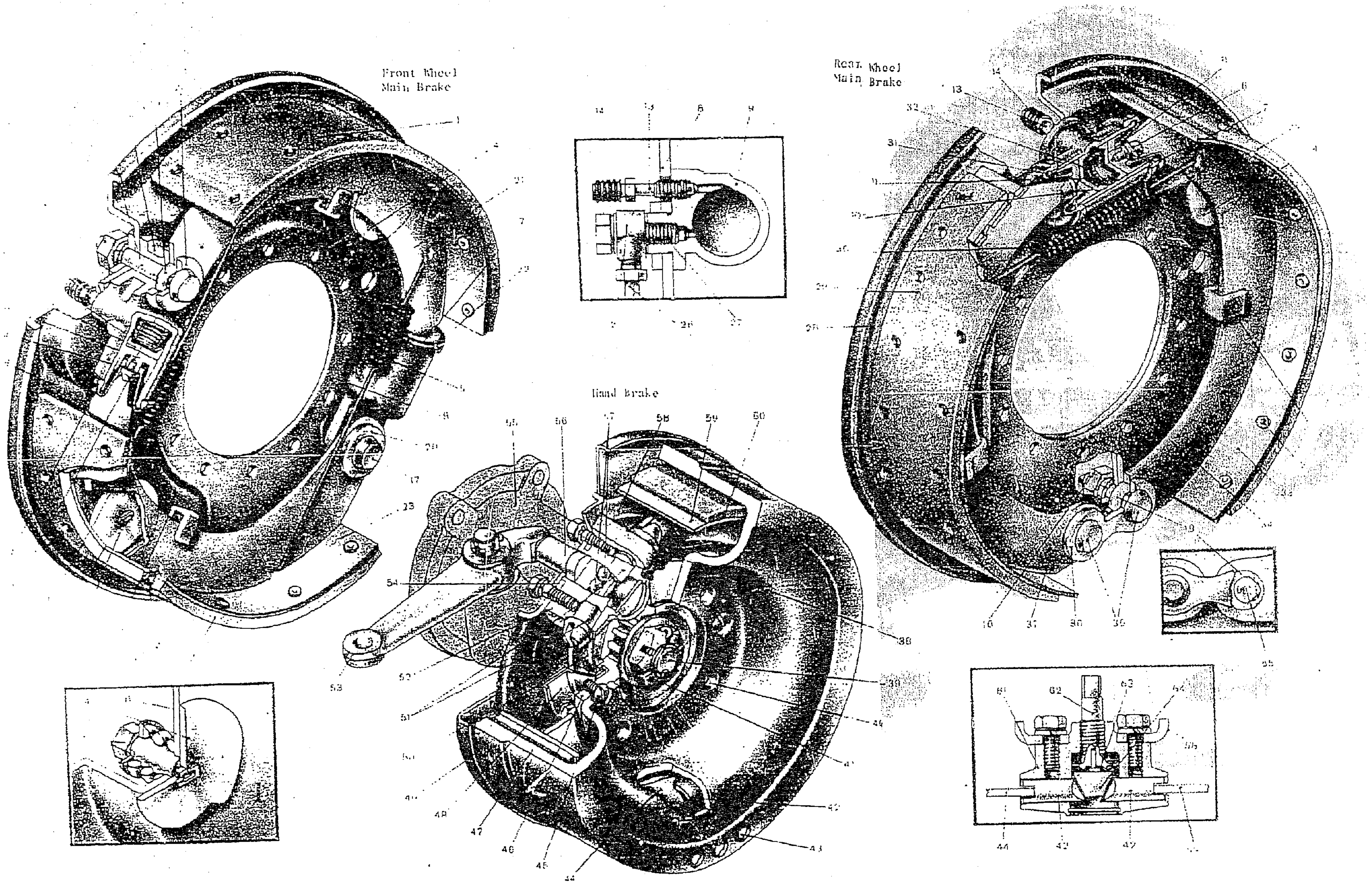
When the adjusting screw is loosened, the shoes are pulled away from the brake drum by their return springs.

The hand brake drive is adjusted only after adjustment of the main brakes. The drive is adjusted by changing the length of the horizontal arm (the vertical arm should always be fully screwed into the drive rod).

<u>Maintenance</u>. During TO-1, check the operation of the main and hand brakes and adjust them if necessary.

During TO-2, clean the wheel brakes, check the condition of the operating surfaces of the drums and linings, tighten the nuts on the brake mounting disk lugs. Each second TO-2, dissemble the spreader mechanism of the hand brake and lubricate its parts with US-2 or US-1 solidole, GOST 1033-51.

1, 29, 60 - friction linings of shoes
2 - friction lining rivet
3 - shoes guide bracket
4 - adjusting eccentric of shoe
5, 30, 38 - brake return spring
6 - tip of piston
7 - protective cap of wheel cylinder
8, 28 - supporting disk (brake mounting disk)
9, 22, 31 - wheel cylinders
10 - wheel cylinder piston
11 - piston collar
12, 32 - cylinder piston spring
13 - bypass valve for bleeding
14 - protective rubber cap
15, 34 - panel strengthener
16 - supporting pin nut
17, 35 - supporing pin of shoe
18 - wheel cylinder lug (cast as unit hole with cylinder)
19 - supporting lug adjusting eccentric
20 - supporting lug washer
21, 23, 33, 37 - wheel brake shoe
24 - hex head of adjusting eccentric screw
25 - connecting collar
26 - brake line
27 - hollow bolt of connecting collar
36 - shoe supporting pin plate
39 - secondary shaft of transfer box
40 - holes for universal joint fork
41 - nut mounting transfer box shaft flange
42 - supporting floating pin of shoe
43 - balancing holes in drum
44 - primary brake drum
45 - screw mounting drum to flange
46 - transfer box flange
47 - hand brake drum
48 - oil reflector
49 - reflector
50 - gland
51 - spreader mechanism pushers
52 - body of spreader mechanism
53 - spreader shaft drive lever
54 - spreader shaft travel limitor
55 - transfer box cover
56 - spreader mechanism shaft
57 - spreader mechanism balls
58 - hand brake mounting disk
59 - central brake secondary brake shoe
61 - adjusting mechanism body
62 - shoe adjusting screw
63 - plate spring (screw fixer)
64 - adjustable spreading thrust block
65 - installation mark



245-a

Central Tire Pressure Regulation System

Basic Data

Purpose -- the central tire pressure regulation system allows the cross-country ability of the truck on soft soils to be increased by decreasing the tire pressure to 0.5-0.7 kg/cm^2. The normal pressure in the tires when driving on hard earth and roads should be 2.8 kg/cm^2.

Type of tires -- tube type, low pressure. Size -- 1,200 × 18.

Wheels -- disk type, with separate rim and spacer ring. Size 800 CV -- 18. Weight of wheel and tire assembled -- 107 kg.

Compressor -- single-cylinder piston type, air cooled. Delivery with counter pressure 6 kg/cm^2 at 1,250 rpm -- 68 l/min. Weight 12.2 kg.

Time required to pump tires up from 0.7 kg/cm^2 to 2.8 kg/cm^2 at engine speed 1,500 rpm -- not over 25 minutes. Time required to reduce pressure in tires from 2.8 kg/cm^2 to 0.7 kg/cm^2 -- not over 5 minutes.

The central tire pressure regulation system is provided on the GAZ-66-01, GAZ-66-02, GAZ-66-04 and GAZ-66-05. This system allows the air pressure in the tires to be changed and controlled both when parked and when driving. The GAZ-66 and GAZ-66-03 do not have this central system. The tires of these trucks are filled when parked through a hose connected to an air compressor of the same design as on the trucks with centralized tire pressure control, installed on the engine.

When the air pressure in the tires is reduced, the tires are deformed, increasing the contact area and decreasing the specific pressure on the ground, significantly increasing the cross-country ability of the truck. In case of slow leaks in the tires, the truck can continue to drive, since the compressor can replace the air which leaks from the tire.

The air pressure regulation system consists of a compressor, air tank 51, control valve 59, pressure regulator 61, safety valve 53, air valves 37, sealing units 45 (installed in the journals of the axles), lines, hoses and manometer 49.

The one-cylinder compressor is installed on the engine and driven by a pulley on the crankshaft of the engine through two drive belts 1 and pulley 2. The drive belt tension is adjusted by tilting the booster pump.

The compressor pulley is installed on the front end of crankshaft 22 and rotates on two bearings. The splined portion of the front end of shaft 22 carries clutch 27. To turn on the compressor, it is necessary to stop the engine and, moving clutch 27 along the splines, engage splined rim 28 with the internal splines 5 of the hub of pulley 2. The clutch is moved by fork 6, fastened to a special shaft; this shaft moves in an aperture in the casing and is fixed by ball stops in two positions, corresponding to compressor on and off. The shaft is lubricated through a press fitting.

The crankshaft of the compressor, made of type 45 steel, rotates in two ball bearings installed in crankcase 26, cast of aluminum alloy.

Cylinder 8, cast of type SCh 18-36 grey cast iron, is mounted on the crankcase and fastened to it by four lugs. To increase the cooling surface, the upper portion of the cylinder has three tall circular ribs.

Piston 9 of the compressor is cast iron, with three rings, the upper two rings 10 being compression rings, while lower ring 21 is an oil wiper ring. The floating-type wrist pin is held against axial movement by two plugs. Connecting rod 7 is a steel I-section piece. Its upper head is a one-piece unit with a bronze bushing of wound strip pressed in. The lower head is split, with two bimetallic bushings. The cap is held on with two bolts. Aluminum cylinder head 12 is a separate piece, held on with four bolts. The head carries inlet valve 20 and delivery valve 11, steel plate-type valves, pressed against their seats by the valve springs. The inlet tube of the head is connected by hose 19 to the air filter of the engine, from which air is drawn during the intake stroke of the compressor piston. In trucks with the central tire pressure regulation system, the head of the compressor carries relief cylinder 15 over the inlet valve. This cylinder, together with the pressure regulator, automatically maintains the pressure in the system between 4-4.5 and 5-5.5 kg/cm^2. When the pressure in the system is below the upper level to which the pressure regulator is adjusted, piston 16 is pressed upward against nipple 17 by the spring. When the pressure in the system exceeds 5.5 kg/cm^2, the regulator connects the relief cylinder to air tank 51, and the air under pressure is delivered to the relief cylinder, moving piston 16 downward. When this happens, the shaft of

the piston opens inlet valve 20 and connects the cavity of the compressor cylinder to the air filter of the engine, so that as the piston moves upward (compression stroke), the air is delivered to the air filter, not to the system, i.e., the compressor operates without load. When the pressure in the system drops to 4-4.5 kg/cm^2, the regulator connects the relief cylinder to the atmosphere, piston 16 and its shaft are moved by spring pressure upward, the inlet valve 20 closes and the compressor begins to deliver air to the system once more.

In trucks not equipped with the central tire pressure regulation system, body 15 on the head of the compressor is replaced with a plug.

The pressure regulator is a ball type, with inlet valve 62 and exhaust valve 63. Inlet valve 62 is pressed against its seat in body 61 by a spring, transmitting its force through thrust balls 66 to shaft 65 and exhaust valve 63. The regulator and tube 69 are connected to the atmosphere through aperture 18 in cap 67 and the channel in seat 64.

When the pressure in the system reaches 5-5.5 kg/cm^2, inlet valve 62, overcoming the force of the spring beneath cap 68, presses upward and presses exhaust valve 63 into seat 64; the compressed air from the system then goes to the relief cylinder through filter 70 and tube 69.

The pressure regulator is adjusted by rotating cap 68 and changing the number of shims beneath seat 64. When the cap is screwed down, the pressure at which the compressor is switched on increases; when it is screwed out, the pressure is decreased. As the number of shims is increased, the pressure at which the compressor is switched off decreases, as it is decreased -- it increases.

Safety valve 55 is a ball-type unit. It is installed on air cylinder 51 in case the pressure regulator fails. The valve opens when the pressure in the system reaches 6 kg/cm^2. When this happens, the ball of the valve is pushed out of its seat, compressing its spring, and air escapes from the system into the atmosphere through the central aperture in the seat and the side aperture in the valve body.

The slide-type control valve allows the inner tubes of the wheels to be connected with the compressor (when the tires are being pumped up) or the atmosphere (when the pressure in the tires is being reduced), and also allows the tires to be sealed (to retain the pressure in the tires). Slide 57 moves relative to body 59 in either direction from its central position by means of the control arm, connected to the lever of the valve, fastened to the non-moving floor of the cabin.

Air from the system enters the inner tubes 35 of the tir.. through sealer units 45, radial and axial channels 42, the apertures in covers 10, the lines and open air valves 37 of the tires.

Operation of the system. Compressed air from head 12 of the compressor moves through delivery valve 11 through tube 14 to air tank 51, from the air tank through tube 50 to body 59 of the control valve and body 61 of the

pressure regulator. The control valve handle has three positions: "increase pressure", "neutral position" and "decrease pressure." The air is fed to tire 34 when the valve is in the "increase pressure" position. Air from the valve travels through nipple 48 and further through tube 47 and hose 29 to the tires of the front wheels, and through hose 56 and tube 52 to the tires of the rear wheels. Stop valves 37 of the tires should be open. With the lever of slide 57 of the control valve in the neutral position and tire stop valves 37 open, manometer 49 shows the air pressure in the tires. The tires are disconnected from the compressor and are not connected to the atmosphere.

Air is released from tires 34 by placing the valve in the "reduce pressure" position with stop valves 37 of the tires open. The air from the tires of the front wheels is transmitted through open stop valves 37 and the channels in covers 40, through channels 42, blocks 45 and hose 29 to nipple 48, through body 49 of the valve and aperture 58 to the atmosphere. From the rear tires, the air reaches the valve through hose 56 and tube 52.

Stop valve 37 should be closed when the truck is parked for extended periods of time and when the truck is driven at over 60 km/hr. When the tire pressure is less than 1 kg/cm^2, the truck should not be driven at over 10 km/hr, and the tires should not be driven for over 450 km at this pressure for their entire service life. At pressures from 1 kg/cm^2 to 2 kg/cm^2, the truck should not be driven at over 20 km/hr, and at pressures from 2 to 2.8 kg/cm^2 -- 30 km/hr. After crossing difficult sectors, the pressure in the tires should be pumped up to 1 kg/cm^2 with the truck parked.

Maintenance. The tire pressure is checked each day. If the system is operating properly and valves 37 are open, the drop in pressure in the tires in 12 hours of parking should not be over 1 kg/cm^2. Leaks can be detected using a soap solution. At the end of the working day, valve 53 should be used to drain condensate from air tank 51.

The technical condition of the tires and tightness of wheel lug nuts must be checked during TO-1. To remove a tire, its side rim 36 must be separated from rim 30 of the wheel, which is fastened to the hub by 14 bolts.

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To avoid injury and protect the threads on the bolts, they should be removed only after the air has been released from the tires.

During TO-2, it is necessary to test the condition of the wheel disks and rims, inspect the tires and rotate the tires. During TO-2, the compressor mounting bolts should also be tightened, belts 1 should be tightened and the ball bearings of hub 4 of pulley 2 and the shaft of compressor shifting fork 6 should be lubricated with solidole type US-2 or US-1.

1 - compressor drive belts
2 - double compressor pulley
3 - oiler for lubrication of pulley hub ball bearings
4 - pulley hub
5 - inner splines of pulley hub for mating of rim of clutch
6 - compressor shifting fork
7 - compressor connecting rod
8 - compressor cylinder
9 - compressor piston
10 - compression rings of piston
11 - compressor delivery valve
12 - compressor cylinder hoad
13 - delivery valve plug
14 - tube feeding compressed air from compressor to air tank
15 - body of relief cylinder
16 - piston of relief cylinder
17 - cylinder plug cover
18 - aperture for connection with atmosphere
19 - hose feeding air to compressor from air filter
20 - inlet valve of compressor
21 - oil-wiper ring of compressor piston
22 - compressor crankshaft
23 - aperture for installation of tube feeding oil from engine lubrication system
24 - compressor casing cover bracket
25 - aperture for tube draining oil from compressor crankcase to engine crankcase
26 - compressor crankcase
27 - compressor clutch
28 - splined rim of clutch
29 - hose connecting left front wheel to tire inflation system
30 - wheel rim
31 - brake drum
32 - spacing rim in tire
33 - valve tube of inner tube (without valve)
34 - tire
35 - inner tube
36 - side of wheel
37 - blocking air valve of tire (tire valve)
38 - disk of wheel
39 - front wheel hub
40 - cover of flange for compressed air feed
41 - guiding flange
42 - channel feeding compressed air to tire
43 - rotating cam journal
44 - driven cam of constant velocity joint
45 - sealing unit (glands)
46 - driving ball of constant velocity joint
47 - tube feeding air to tire of right front wheel
48 - nipple of valve feeding fresh air to centralized tire inflation system
49 - manometer for checking pressure of air in tires
50 - tube feeding compressed air to control valve and pressure regulator.
51 - air cylinder
52 - tube feeding air to left rear tire
53 - condensate drain valve
54 - air drain valve
55 - ball-type safety valve
56 - hose feeding air to right rear tire
57 - control valve slide
58 - aperture draining compressed air to atmosphere
59 - body of valve controlling air pressure in tire inflation system
60 - tube feeding compressed air to pressure regulator
61 - body of pressure regulator
62 - pressure regulator inlet valve ball
63 - pressure regulator exhaust valve ball
64 - exhaust valve seat
65 - valve shaft
66 - adjusting cap thrust balls
67 - pressure regulator protective cap
68 - pressure regulator adjusting cap
69 - tube feeding compressed air from pressure regulator to relief device
70 - filter of pressure regulator
71 - rear axle beam
72 - right half axle
73 - flange of half axle (made as unit hole with half axle)
74 - rear wheel hub journal
75 - rear wheel hub

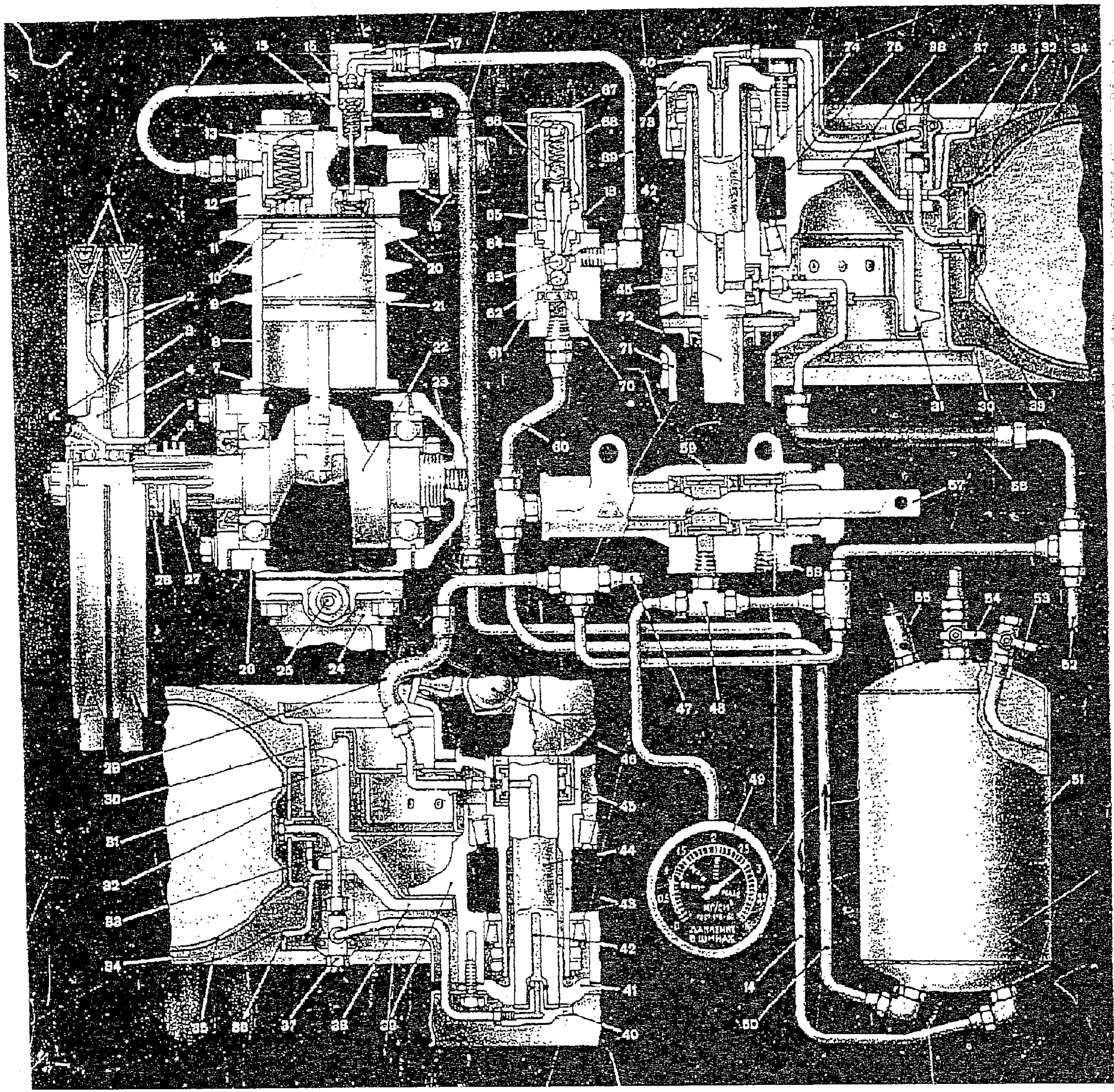


Diagram of Operation of System
as Air is Fed to Tires
(Increase in Pressure)

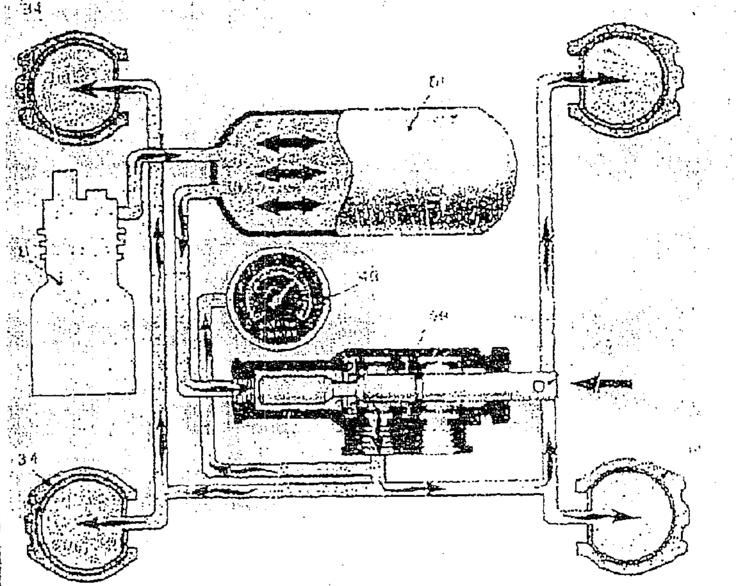
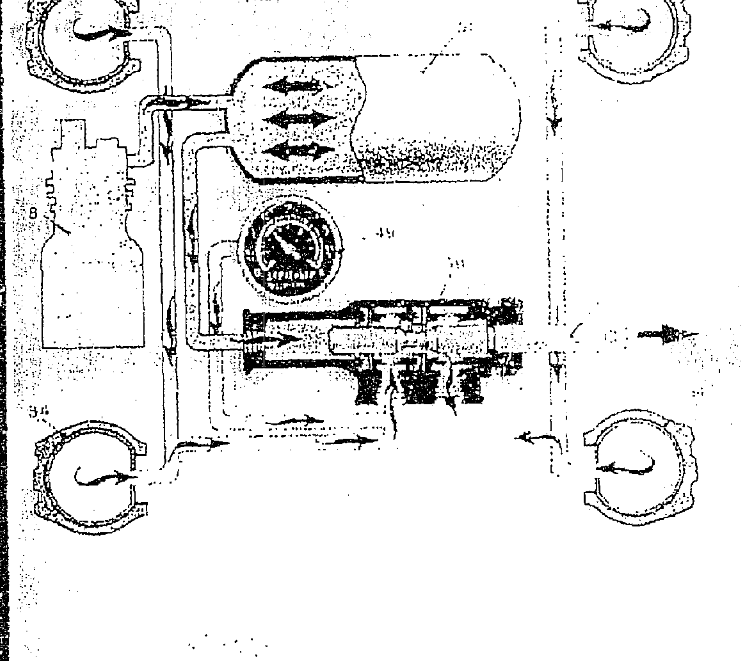


Diagram of Operation of System
as Air is Released from Tires
(Reduction of Pressure)



Winch and Power Takeoff

Basic Data

Winch

Two speeds: for winding and unwinding winch cable.
Transfer ratios (from engine):
  winding 2.41:1
  unwinding 1.7:1
Weight of winch -- 18.3 kg

Power Takeoff Box

Transfer number of globoid drive -- 24
Cable length -- 50 m
Cable diameter -- 12.5 mm
Limiting force on cable -- 3,500 kg
Reducing drive case capacity -- 0.8 1
Weight of winch -- 125 kg

The GAZ-66-02 and GAZ-66-05 trucks are equipped with a winch designed to pull the truck and trailers over difficult terrain sectors.

The winch is mounted in front of the radiator and is fastened to two angle brackets riveted to longitudinal frame members. It consists of the reducer and drum 35, on which steel cable 36 is wound. The winch is connected by the power takeoff box to the transmission of the truck.

The power takeoff box is mounted on lugs on the right side of the transmission. Its driving gear 64 is in constant mesh with the third gear of the intermediate shaft of the transmission and its spiral-cup (rear) gear wheel 63 meshes with intermediate shaft 62 of the power takeoff.

The takeoff box has two gears -- one for winding in the cable onto the drum and one for unwinding the cable. Shifting to either gear is performed by moving the sliding block along the splines of driven shaft 67. The power takeoff box is controlled by the driver from the drivers seat by lever 58, connected by a keyed pin to shaft 56 on which shifting fork 57 is mounted. The shaft can be fixed in one of three positions, corresponding to engagement of the transmission or the neutral position of the lever.

When the transmission is in the "wind" position (rear most position of lever 58), rim 58 of the sliding gear block meshes with straight-cut rim 66 of the intermediate shaft. In the "unwind" gear (extreme forward position of the lever), rim 60 of the sliding gear block meshes with driving gear 64.

To prevent accidental shifting of the power takeoff, lever 58 is held in the neutral (center) position by a special tilting stop loop on the floor of the truck cabin.

The torque from driven shaft 67 of the power takeoff is transmitted to the winch reducer by a drive train consisting of two drive shafts. Between the shafts is intermediate support 23, the cast iron body of which is bolted

to the right longitudinal frame member. The body contains two ball bearings, in which short shaft 22 rotates. Each end of the shaft carries splined flanges 21 on which the winch drive shafts are mounted. The nuts fastening the flanges to shaft 22 are keyed.

The universal joints of the winch drive are not interchangeable with the universal joints of the main drive train.

Driven fork 16 of the front universal joint driving the winch is seated on the shaft of worm 4 of the reducer and connected to it by keyed safety pin 15. The clearance in the seating of the fork is 0.12-0.18 mm. The maximum permissible clearance of the safety pin is 0.158 mm.

Safety pin 15 will break if the force on the cable begins to exceed the maximum permissible force (3,500 kg). It is made of bar steel (type 20) with rockwell hardness B 85-100; bolts or other objects must not be used to replace the safety pin. The use of a pin with hardness higher than the standard hardness may result in damage to the winch and its drive. If the strength of the pin is insufficient, the permissible force on the winch cable will be reduced.

The winch reducer is mounted in cast iron casing 3 and consists of worm gear 4 and driven gear 5. The single-pass globoid worm rotates on two tapered roller bearings. The tension in the bearings is adjusted by shim set 2 beneath the flange of cover 1 of the front worm bearing. The set consists of one cardboard shim 0.3 mm thick and three steel shims 0.2, 0.15 and 0.1 mm thick. After adjustment, the worm should rotate so that slight resistance is felt. No clearance in the bearings is allowed.

The worm meshes with driven gear 5, which consists of a cast iron hub and a bronze rim (24 teeth). The lateral clearance in the worm gear mesh is 0.15-0.25 mm.

The driven gear is rigidly fastened to the winch shaft by two keys 30. Adjusting ring 29 is used to regulate the position of the driven gear relative to the worm. The tension of driven gear 5 is regulated by changing the number of shims beneath cover 26 of the winch casing.

After adjustment of this shaft, the winch should rotate freely with an axial displacement of not over 0.08 mm.

The friction surfaces of the reducing mechanism are lubricated with oil, poured into the crankcase through filler plug 31. The crankcase also has two other apertures. One is used to check the oil level, the other for drainage. All three apertures are closed with threaded plugs.

Shaft 7 passes through the entire winch and has three bearing points 27, 32 and 38 -- in the cover, left wall of the case and in the traverse, rigidly fastened to the two angle brackets of the winch. Metal ceramic bearings are pressed into these points, acting as friction bearings for the shaft. The clearances in the case and cover where the shaft is joined to the hubs are 0.025-0.085 mm, while the clearances in the traverse are 0.1-0.175 mm.

The drum can be rotated in either direction (to wind or unwind the cable) by the winch shaft using sliding cam clutch 42, which meshes with the cams of the driving plans of the drum. The clutch is moved by fork 34, which is moved by lever 41. The fork lever has a stop to fix the clutch in the engaged and disengaged positions. The fork fixer stop on the upper flat of the bumper is fastened so that when the fork is in the engaged position, the clearance between its stop and the rest is 1 mm.

When the cams are disengaged, the line can be unwound manually. Drum rotation is slowed by the drum brake in this case, since brake shoe 51 is pressed against the edge of the drum by the spring of bolt 53.

In addition to the drum brake, the winch has an automatic strip brake installed on the worm shaft in separate casing 11 with cover 14. This brake is designed to slow down the reducer worm during unwinding of the cable under load, which may occur due to breakage of safety pin 15 or if the clutch of the truck is depressed as the winch is being wound in.

The automatic brake consists of brake drum 12 and the braking strip with friction liner 13. One end of the strip is fastened to the case by short tip 47. The other end of the strip is held by a spring on long tip 46. This causes the brake strip to lie tight against the drum.

During winding of the cable, the winch shaft and brake drum rotate counter clockwise (illustrated by arrow A), which compresses spring 44 and reduces the tension on the brake strip. This allows free rotation of drum 12 and, consequently, the reducing drive of the winch.

During unwinding of the cable under load, the brake drum begins to rotate in the reverse direction -- clockwise (illustrated by arrow B), causing self-tightening of the brake strip on the drum. This causes breaking of the winch drum.

Cable 36 is fastened to the rim of the drum by a U-bolt and nut. The opposite end of the cable carries a chain and hook. There is a notch on the front bumper of the truck to guide the cable, carrying a guiding device consisting of three steel rollers -- the lower horizontal and two vertical side rollers. The rollers turn on shafts fastened to cast iron brackets. The clearance between the shafts and bushings is 0.14-0.42 mm.

The winch cable should not be fully unwound when used. Three to four turns should be left on the drum, to prevent the cable from pulling out of its end fitting.

The winch should be unwound manually after disconnecting the winch clutch. The "unwind" gear can also be used. When this is done, the cable must also be pulled out manually.

To unwind the winch, after starting the motor, with the transmission in neutral, press the clutch pedal and put the power takeoff lever in the unwind position, then release the clutch smoothly. The speed of the engine should not be increased.

To use the winch to pull the truck forward when it is stuck, unwind the cable, then fasten its hook to some strong object. Then engage the cam clutch, then, with the engine operating, press in the clutch pedal, engage the front axle, reducing drive in the transfer box, first gear of the transmission and place the power takeoff shift lever in the wind position. Then release the clutch and bring the engine up to a moderate speed.

To pull out another vehicle or trailer which is stuck, first select the most convenient postion to park the truck, set the hand brakes and, if necessary, fasten it to some strong object. Then unwind the cable, fasten it to the vehicle (or trailer) to be pulled out and engage the cam clutch. With the engine operating and the transmission in neutral, push in the clutch pedal and set the power takeoff lever in the wind position. Then release the clutch, and increase the engines speed to a medium speed.

In case the safety pin breaks, immediately depress the clutch pedal and shift the power takeoff lever to its middle (neutral) position. If this is not done, the universal joint forks may be seized against the shaft. The broken pin must be replaced.

When operating the winch, keep in mind that as the radius of the cable wound onto the drum decreases, the forces increase. Therefore, when pulling the vehicle it is best to select a more distant object to which to attach the hook, and when pulling out another vehicle it is best to move the truck with the winch back some distance, using the block and block chain of the winch. The moving block allows the total pulling force to be increased.

Cam clutch 42 should be constantly in mesh with the driving flange of the drum. It is released only when the cable is being unwound manually.

In order to avoid accidents when working with the winch, the safety rules must be carefully observed.

Care of the winch consists in maintaining it clean and periodically lubricating the mechanism. The gears and bearings of the power takeoff box are lubricated with oil poured into the transmission. When the oil is drained

from the transmission, the oil must also be drained from the power takeoff box by removing plug 55.

The following are lubricated in TO-1:

-- the guide rollers of the winch cable (2 points) and the shaft of the winch drum (2 points) with grease;
-- splines 35 of the winch drum shaft, with the oil used for the motor.

The universal joints on the winch drive shaft (4 points) are lubricated in summer with TAp-15 oil, in winter with TAp-10 oil, GOST 8412-57.

During TO-2, furthermore, the oil level in the reducing crankcase is tested and brought up to the level of the checking plug if necessary. Each second TO-2 (11,000-17,000 km), the oil is completely changed. Type MT-16p oil, GOST 6360-58, is used in the crankcase.

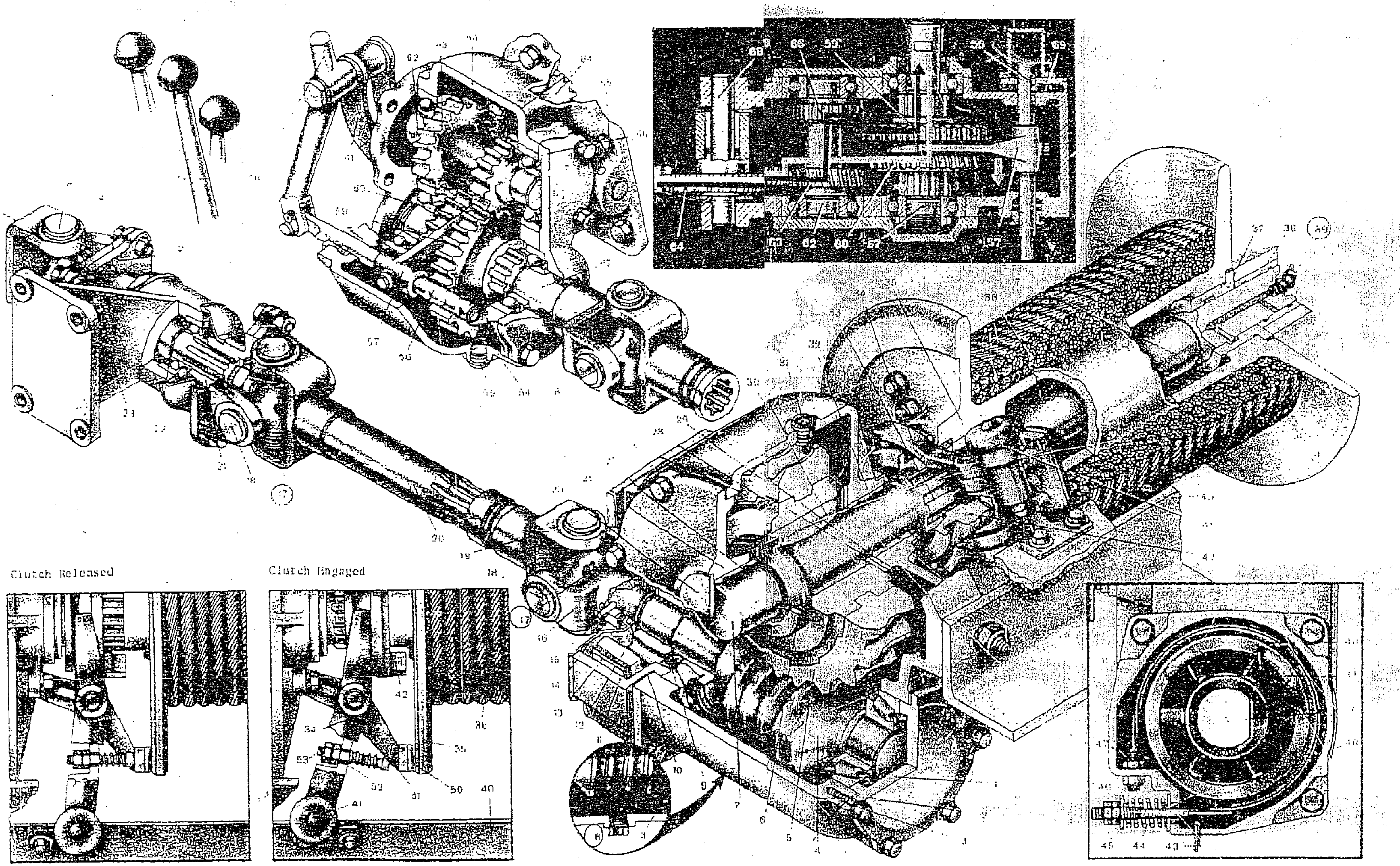
When the winch is used, check the condition of the cable and clean and lubricate it with liquid oil as necessary. Periodically, checks should be made to be sure that oil (or water) has not accumulated in the automatic brake case. There is an aperture for drainage of fluid in the bottom of case 11, closed with key 43. The automatic brake can be adjusted as necessary. This is done by tightening spring 44 of the brake band with adjusting nut 45 on tip 46. It should be adjusted so that following 3 to 5 minutes of winding the cover of the brake case does not become too hot to touch.

The drum brake is adjusted by changing the tension of its spring with nut 52 on bolt 53 of the brake shoe. It should be adjusted so that when the cable is unwound by hand, the drum does not rotate too freely, i.e., the cable does not become loose on the drum.

The worm drive is generally not adjusted during operation of the winch. It should be adjusted only when parts are changed or in case of great wear of the bearings.

1 - worm front bearing cover
2 - shim for adjustment of worm tapered roller bearing tension
3 - winch reducer case
4 - globoid worm of reducer
5 - driven gear of reducer
6 - small spacing washer
7 - winch drum shaft
8 - plug in drain aperture of reducer case
9 - reducer gland
10 - shims for adjustment of axial position of worm (adjusted at plant)
11 - automatic winch strip brake case
39 - oiler for lubrication of rear drum bushing (oiler for lubrication of front drum bushing installed on flange of drum on cam clutch side)
40 - bumper mounting bracket
41 - drum shift lever
42 - drum shift cam clutch
43 - automatic brake case drain hole key
44 - automatic drum brake band spring
45 - band spring tension adjusting nut
46 - moving band mounting tip
47 - nonmoving band mounting tip
48 - left band brake lining
49 - right band brake lining

12 - automatic brake drum
13 - friction liner of automatic brake band
14 - automatic brake case cover
15 - winch safety pin
16 - driven fork of universal joint
17 - universal joint oiler
18 - universal joint cross
19 - driving fork of universal joint
20 - drive shaft (made as unit hole with universal joint fork)
21 - flange with reflector connected to intermediate support shaft
22 - intermediate support shaft of drive shaft
23 - drive train intermediate support
24 - flange with reflector connected to drive train from power takeoff box
25 - winch case cover plug
26 - winch case cover
27 - drum shaft front bearing
28 - worm gear spacer washer
29 - ring for adjustment of position of worm driven gear (adjusted at factory)
30 - worm gear key
31 - oil filler plug
32 - central bearing of drum shaft
33 - splines of drum shaft carrying cam clutch
34 - cam clutch fork
35 - winch drum
36 - winch cable
37 - winch drum bushing
38 - rear bearing of drum shaft
50 - cam clutch drum brake lining
51 - drum brake shoe
52 - adjustment nut of shoe bolt
53 - drum brake shoe bolt
54 - power takeoff box case
55 - drain aperture plug
56 - transmission shift lever
57 - transmission shift fork
58 - lever shifting power takeoff box (in truck cabin)
59 - straight-tooth rim of sliding gear block (rim of wind gear meshes with rim 66)
60 - spiral-cut rim of sliding block of gear (rim of "unwind" gear meshes with gear 64)
61 - shift lever support
62 - intermediate shaft of power takeoff (made as unit hole with rim)
63 - spiral-cut intermediate shaft rim (meshed with gear 64)
64 - power takeoff driving gear
65 - bolt mounting power takeoff box to transmission
66 - straight-cut intermediate shaft rim
67 - driven shaft of power takeoff box
68 - axis of driving shaft of power takeoff box
69 - ball and spring of shift lever stop


Clutch Released
Clutch Engaged

Lubrication Schedule for the GAZ-66

Winch and Drive

1. During TO-2, change MT-16p oil in winch reducer (reducer case capacity 0.8 l). Check oil level each month.

2. During TO-1, lubricate splines of drum shaft and winch clutch with AS-8 motor oil.

3. During TO-1, lubricate universal joints of winch drive with TAp-10 or TAp-15 transmission oil through cross oilers until all lubricant is forced from cross valve.

4. During TO-1, lubricate winch drive shaft and winch cable guide rollers with US-1 or US-2 (I) grease through press oilers.

Engine

5. Each day, check level of AS-8 motor oil in crankcase and add if necessary.

6. Each second TO-1, change AS-8 motor oil in crankcase (system capacity 8 l).

7. Each third TO-1, change AS-8 motor oil in air filter. When used under very dusty conditions, change oil every other day (filter capacity 0.55 l).

8. During TO-1, pour 20-25 drops of AS-8 motor oil into tube of governor sender.

9. During TO-2, lubricate shaft of compressor shift fork and drive pulley bearing with US-1 or US-2 (I) lubricant through press oiler.

Transfer Box, Hand Brake and Brake Booster Filter

10. During TO-1, check level of TAp-10 or TAp-15 transmission oil in transfer box case.

11. Each second TO-2, change transmission oil type TAp-10 or TAp-15 in transfer box case (case capacity 1.5 l).

12. During TO-1, lubricate transfer box control lever shaft through press oiler with US-1 or US-2 (I) lubricant.

13. During TO-2, dissemble and lubricate spreader mechanism of hand brake with US-1 or US-2 (I) lubricant.

14. Each third TO-1, wash air filter of vacuum brake booster with kerosene and immerse it in AS-8 motor oil.

Drive Shafts

15. During TO-1, lubricate needle bearings of universal joints with TAp-10 or TAp-15 transmission oil; force in oil until fresh lubricant appears at cross valve.

16. Each third TO-2, dissemble drive shafts, clean and lubricate their splines, adding fresh type 1-13 high-temperature lubricant.

Rear Wheel Hub Bearings

17. In axles with tire pressure regulation system, each second TO-2, wash bearings and hubs of rear wheels with kerosene and add 250 g fresh type 1-13 lubricant to each hub.

18. In axles with no tire pressure regulation system, hub bearings are lubricated with type TS-14.5 hypoid gear oil from differencial. This oil is changed each second TO-2.

Shock Absorbers and Springs

19. Once per year, change shock absorber fluid -- AMG-10 oil (shock absorber capacity 0.41 l).

20. Once per year, and if sqeaking or rust are noted, dissemble springs and lubricate leaves with USs-A graphite lubricant or a mixture of 30% grease, 30% graphite and 40% transformer oil.

Hypoid Main Drives of Front and Rear Axles

21. During TO-1, check oil level of TS-14.5 hypoid gear oil in axles.

22. Each second TO-2, change TS-14.5 oil in axles (capacity of differential casing for truck with no tire pressure regulation system 7.6 l, for trucks with tire pressure regulation system 6.4 l; capacity of front differential casing 7.7 l).

Towing Hitch

23. Each TO-1 (when operating with a trailer), lubricate hitch rod with US-1 or US-2 (1) lubricant through press oiler.

24. When operating without trailer, each TO-2, lubricate hitch rod with US-1 or US-2 (1) lubricant through press oiler.

Battery

25. Twice per year, clean battery terminals of oxides and lubricate noncontact surfaces and cross bars with technical vaseline.

Transmission

26. During TO-1, check level of TAp-10 or TAp-15 transmission oil in transmission and add if necessary.

27. Each second TO-2, change transmission oil in transmission (capacity of case without power takeoff box 3.0 l, with power takeoff box 4.2 l).

Ignition Distributor

28. Each second TO-1, rotate cap oiler to feed type TsIATIM-201 high-temperature lubricant to distributor shaft bushing.

29. Each third TO-2, wash cap oiler and fill with fresh TsIATIM-201 lubricant. Cover braker cam with a thin layer of lubricant.

30. Each 40,000-50,000 km, wash ball bearing of braker plate and insert fresh TsIATIM-201 lubricant or special LZ-158 lubricant.

31. Each second TO-1, lubricate hammer shaft with a few drops of AS-8 oil and wash brush and bushing of cam.

32. Each third TO-2, soak cam brush with turbine oil 22 (turbine L) and lubricate distributor shaft and hammer shaft bearings with industrial oil 45 (machine S).

Steering System

33. During TO-1, check level of oil in tank of power steering booster pump.

34. Twice per year, change type AU (winter) or turbine 22 (summer) oil in tank and power steering booster system.

35. During TO-2, check level of TAp-10 transmission oil in steering mechanism casing.

36. Twice per year, change TAp-10 transmission oil in steering mechanism casing.

37. Twice per year, lubricate universal joints of steering column with transmission oil TAp-10 or TAp-15.

38. During TO-1, lubricate steering arm joints with US-1, US-2 (I) lubricant or 1-13 high-temperature lubricant.

39. During TO-1, lubricate power cylinder joint with US-1 or US-2 (1) through press oiler.

Front Driving Wheels

40. Each second TO-2, wash bearings and hubs of front wheels with kerosene and add 250 g type 1-13 high-temperature lubricant to each one.

41. During TO-2, add 200 g U-joint lubricant to each universal joint of front axle rotating cam.

42. Each second TO-2, wash constant velocity joint with kerosene and add 500 g U-joint lubricant to each joint.

43. Each second TO-2, wash sealer system gland unit and add fresh type 1-13 lubricant to cavity between collars.

44. During TO-1, add 50 g U-joint lubricant to rotating cam kingpin bearings.

45. Twice per year, wash bearings of rotating cam kingp ns and add fresh U-joint lubricant.

Clutch and Brake and Clutch Master Cylinders

46. During TO-1, rotate cap oiler to feed 1-13 lubricant into clutch bearing until it is filled.

47. During TO-1, check level of GTZh-22 brake fluid in master cylinder.

48. Each second TO-1, drain GTZh-22 brake fluid, filter it and return it to master cylinder.

49. During TO-2, but at least twice per year, replace GTZh-22 brake fluid in brake and clutch systems.

Water Pump

50. During TO-1, lubricate water pump bearings through press oiler with 1-13 lubricant until fresh lubricant comes out of test aperture.

Note: The work to be performed in each lower type of maintenance (for example TO-1) is generally included in the next higher type of maintenance (for example TO-2), except when the lower type of maintenance requires that the lubricant level be checked or lubricant be added, while the higher type of maintenance requires replacement of the lubricant.

Symbols for Periods of Lubrication of GAZ-66 Recommended by Factory

Symbol	Lubrication Period
△	Daily
☆	TO-1 (1,100-1,700 km
□	Each second TO-1 (2,200-3,400 km)
◠	Each third TO-1 (3,300-5,100 km)
○	TO-2 (5,500-8,500 km)
⬡	Each second TO-2 (11,000-17,000 km)
◇	Each third TO-2 (16,500-25,500 km)
⏢	Twice per year (spring and fall)
⏢	Once per year

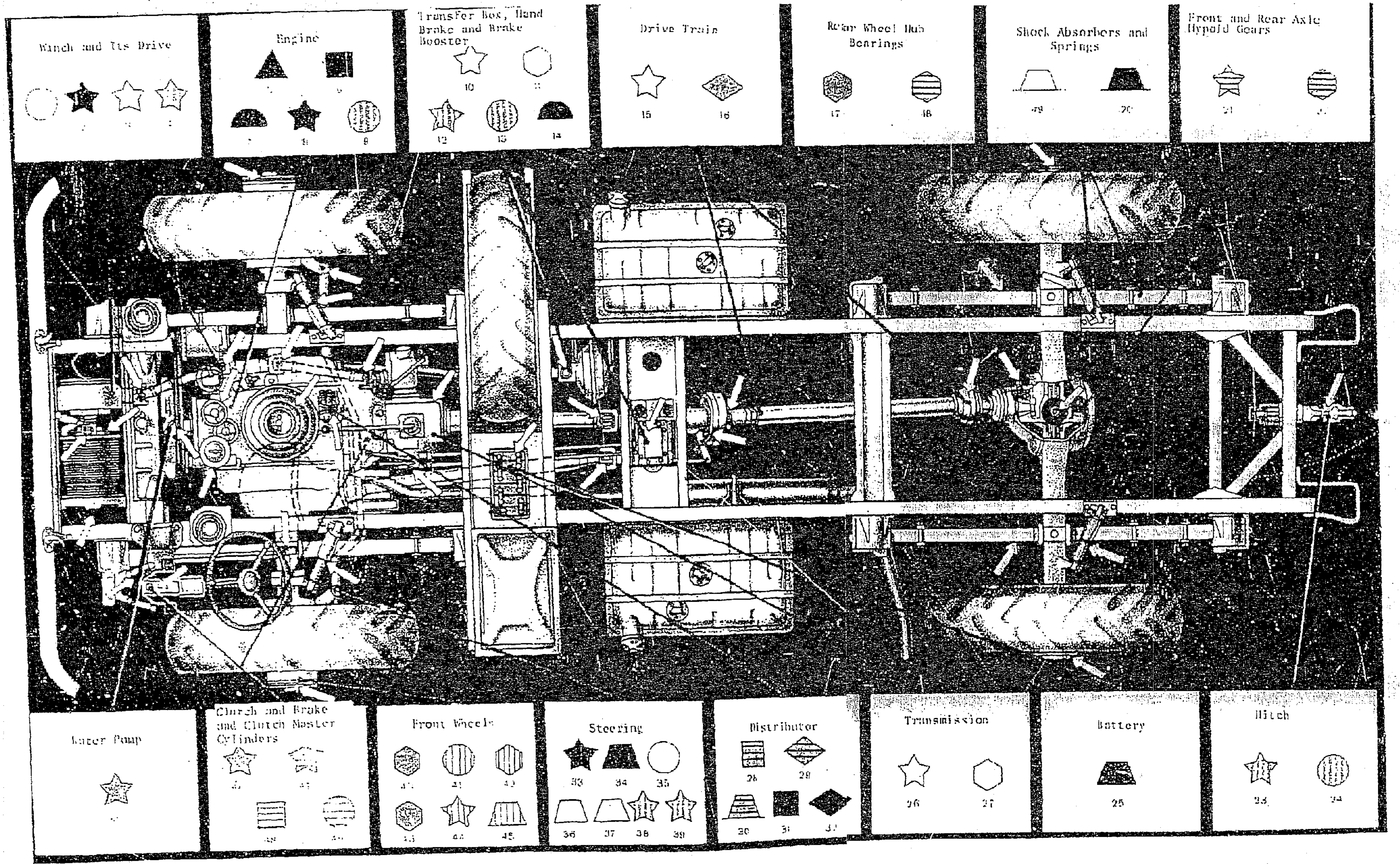
Key: table, last page

Title: Symbols of Lubricants and Operating Fluids Used

A. AS-8 (MBB) motor oil (GOST 10541-63)
B. MT-16p oil (GOST-58)
C. Transmission oil with additive (GOST 8412-57), winter -- TAp-10; summer -- TAp-15
D. Oil (hypoid) type TS-14.5 with chloref-40 (TU TNZ 128-63)
E. Steering system fluid: winter -- type AU spindle oil (GOST 1642-50), summer -- type 22 turbine oil (GOST 32-53)
F. Shock absorber fluid -- AMG 10 oil (GOST 6794-53)
G. Universal greases (GOST 1033-51), fatty greases: US-1 winter, US-2 (1) summer
H. Universal high-temperature water resistant grease UTV 1-13 (GOST 1631-61)
I. Universal high-temperature water resistant, freezing resistant activated grease type UTVMA TsIATIM-201 (GOST 6267-59)
J. Mixture of 70% US-2 and 30% TAp-15 transmission oil or type AM U-joint oil (GOST 5730-51)
K. Universal low-temperature lubricant UN, technical vaseline (GOST 782-53)
L. Universal medium-temperature synthetic graphite lubricant type USs-A (GOST 3333-55)
M. GTZh-22 brake fluid (TU MKhP 3959-53)

Frequency and Type of Lubricant
(Numbers refer to Lubrication Chart Symbols)

1. TO-2 (5,500-8,500 KM), Type B
2. TO-1 (1,100-1,700 KM), Type A
3. TO-1, Type C
4. TO-1, Type G
5. Daily, Type A
6. TO-1, Type A
7. Each third TO-1, Type A
8. TO-1, Type A
9. TO-2, Type G
10. TO-1, Type C
11. Each second TO-2, Type C
12. TO-1, Type G
13. TO-2, Type G
14. Each third TO-1, Type A
15. TO-1, Type C
16. Each third TO-2, Type H
17. Each second TO-2, Type H
18. Each second TO-2, Type D
19. Once a year, Type F
20. Once a year, Type L
21. TO-1, Type D
22. Each second TO-2, Type D
23. TO-1, Type G
24. TO-2, Type G
25. Twice per year, Type H
26. TO-1, Type C
27. Each second TO-2, Type C
28. Each second TO-1, Type I
29. Each third TO-2, Type I
30. Once a year, Type I
31. Each second TO-1, Type A
32. Each third TO-2, Type E
33. TO-1, Type E
34. Twice a year, Type E
35. TO-2, Type C
36. Twice a year, Type C
37. Twice a year, Type C
38. To-1, Type G
39. TO-1, Type G
40. Each second TO-2, Type H
41. TO-2, Type J
42. Each second TO-2, Type J
43. Each second TO-2, Type H
44. TO-1, Type J
45. Twice a year, Type J
46. TO-1, Type H
47. TO-1, Type M
48. Each second TO-1, Type M
49. TO-2, Type M
50. TO-1, Type H



Winch and Its Drive
Engine
9
Transfer Box, Hand Brake and Brake Booster
10
12
13
14
Drive Train
15
16
Rear Wheel Hub Bearings
17
18
Shock Absorbers and Springs
Front and Rear Axle Hypoid Gears
Water Pump
Clutch and Brake and Clutch Master Cylinders
Front Wheels
45
Steering
33
34
35
36
37
38
39
Distributor
28
29
30
31
Transmission
26
27
Battery
25
Hitch
23
24

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